

GLANVILLE

PLUS

ULTRA

1668







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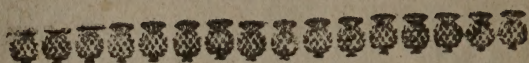
THE UNIVERSITY OF CHICAGO

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Imprimatur,

Tho. Tomkyns, *RR^{mo} in Christo*
Patri ac Domino D^{no} Gilberto
Divinâ Providentiâ Archi-
episc. Cant. à Sacr. Dom.

Ex *Ad. Lamb.*
Maii 2. 1668.



PLUS ULTRA:
OR, THE
Progress and Advancement
OF
KNOWLEDGE
Since the Days of
ARISTOTLE.

In an ACCOUNT of some of the most
Remarkable
LATE IMPROVEMENTS
OF
Practical, Useful Learning:

To Encourage
PHILOSOPHICAL ENDEAVOURS.
OCCASIONED
By a Conference with one of the
NOTIONAL Way.

By *JOS. GLANVILL.*

LONDON,
Printed for James Collins at the Kings-Head
in Westminster-Hall. 1668.



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TO THE

Right Reverend Father in G O D,

WILLIAM

Lord Bishop of Bathe and Wells.

MY LORD,

TIs a common, and vain
pretence in Dedicati-
ons, That the Name of the
Great Person is prefixed to
keep off Censure: And if it
would do so in earnest, the
Author might secure himself
upon easie terms; and those
that write Books, need not
complain so much of the
A Tongues

The Epistle

Tongues of the Envious, and the Ignorant: But the worst on't is, they that use the Courtship, intend it for no other; and know, that they are no more secure under the Title of their Patron, than a Man in Battle is behind a Target made with a Paper-Picture of St. George.

But, my Lord, though I condemn those silly, Roman-tick kinds of Flatteries, yet I have a real need of your Lordship's Name, which, without this Vanity, I may use in my defence: since the Angry Gentleman, that gave occasion to the following Discourse.

Dedicatory.

scourse, hath usurp'd it to give colour to his Reproaches. What are the Particulars, I have told your Lordship, and have mentioned them in some of the nearest ensuing Leaves. And since the Ban of Disputations hath accused me for an Infidel, and framed a Story concerning your Lordship to confirm it, I think it not sufficient to confute the Charge, but must also shame the Legend: which, no doubt, your Name here prefixt, and the Assurance you were pleas'd to give me that it was not true, will do effectually.

The Epistle

It becomes not me, my Lord, to suggest any Reflections to kindle your displeasure for this Invention,, to which certainly your Lordship owes no great Acknowledgments: But to decline all things that look like Envy or Revenge, I humbly implore on his behalf, your Pardon of the Forgery; and on my own, your Permission to deal with this Disputer. This perhaps some may judge a bold Offer, in one that pretends not great Matters, to undertake the Dan of Gath; but I have no dread of the formidable bulk of his Name and Arms (and

Dedicatory.

(and some think, Most of the famed Giants, were indeed but Men of ordinary stature.) For the Reputation of a great Disputant, which my Assailant hath in this Country, it signifies no more with me, than that of a good Cudgel-player, or Master of Fence: and what this Doughty Man's Art and Force is, I have seen so much, as instructs me, that there is no great reason to apprehend mighty Dangers from his Puissance. My Lord, I have no contempt of any Mans Parts or Person, that keeps himself within the
A 3 bounds.

The Epistle

bounds of Modesty and Civility : but for those that are confident, imperious, abusive, and assuming, I confess 'tis hard for me to speak of them with much complement or respect.

*And having taken the boldness to say all this, some perhaps may expect that I should have the Duty and Justice to say a great deal more ; and that I should celebrate your Lordship after the manner of Dedications : But I began with reprov-
ing one of those usual Vanities, and shall not end in the practice of another. Those Epi-
stolary*

Dedicatory.

stolary Praises are mostly intended for little, and go for nothing; For Flattery and Poetick Youth have strain'd them to such a ridiculous height, that Wise men judge of them by the same measures, as they do the Courtships of Common Amours. I dare not therefore offer your Gravity and Wisdom such vulgar and obnoxious Trifles; but instead of those Fooleries, I give your Lordship the serious assurance of my affectionate Duty, with the most grateful acknowledgment of your Favour. And that your aged
A 4 Head.

The Epistle, &c.

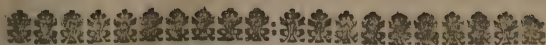
*Head may be Crowned with
all the Blessings of a long
Time, and after that, with
the full Glories of an happy
Eternity, shall ever be the
Prayer of,*

My Lord,

Your Lordships obliged
and dutiful Servant,

JOS. GLANVILL.

THE



THE
PREFACE
TO THE
REVEREND CLERGY
OF THE
Diocess of *B. and W.*

FATHERS and BRETHREN,

THE Respect I owe you, and
the Relation the following
Discourse hath to a Reverend Man of
your Number, make me reckon my
self obliged, in point of Civility and
Decorum, to give you an Account of
this Engagement; Not that I think
so meanly of *YOU*, or of my Cause,
as to endeavour to bribe or flatter
You into any partiality of judgment in
my .

Preface.

my favour, which no doubt You would *disclaim*, and, I hope, I shall not need: But I judge an Information in some Particulars, may be necessary to a *free and unprejudiced Examination* of the things contained in these Papers. And I begin with the desire, That you would consider me as a Person that contemns all *Wranglings*, and *vehemencies* of *Dispute*; and there is somewhat of *Hell* in all Wars: Especially I dislike and lament all *Publick Controversies* among those of the *Sacred Function*, by which, great disrepute and reproach have been brought both upon *Them* and *It*; besides the other numerous *Mischiefs* they have done *Religion*, and the *Peace* of Men. And in those Differences, in which *eager Theologues* have been engaged, I have much pitied the *meanness* and *disorders* of their Spirits, in the *dissimilarity*

Preface.

nuity and violence of their Assaults upon one anothers Reputations, in which the *Question* was not concerned; but the *Cause* of each, much dis-served by their respective abuses. By which *Premisals*, You may perhaps think, that I am drawing up a Charge against my own *Discourse*, which relates a *Controversie*, and one with a *Divine*, that some possibly may judge too, not to savour in the menage of it, of so much *Candour* and *modest Sweetness* as I seem to recommend. The *Answer* of *this*, will be the *first* business of this
P R E F A C E.

Therefore, for the *publishing* the matter of a *Dispute*, and that which was *privately* begun, I have to say, That the *Grave Man* gave me occasion enough of *Displeasure* and *Complaint*, by the *dreadful* and most *injurious Censure* of *Atheism*, charged

Preface.

ged upon me, for saying no more than that [*The Scripture is not writ after the way of our Methods; and, that God in those Holy Oracles did apply himself much to the Imagination of the Prophets.*] The former of which Sayings, is so evident to one that considers the *Inspired Writings*, that it will no doubt readily be granted by *Wise men* of all *denominations* in *Religion*; and I should much wonder it is by any one made a *question*, but that we are fallen into an *Age* in which no *Truth* and *Evidence* can secure any thing from the *Captiousness* of *Disputers*. For the other, I have the *Suffrage* of all that ever pretended to understand any thing of the *Prophetic Spirit*, as I could at large make appear, if I thought any needed *information*

Preface.

formation and conviction in this matter, besides my **Reverend Antagonist** : Or, if I had neither *Evidence* nor *Authority* to vouch me in those Sayings ; yet the Charge of **Atheism**, is like the bolt of one that throws hard words in haste, and without aim or judgment.

So that I had cause enough to be angry at an *Imputation* so little agreeing with the *Discretion* of a *Wise man*, the *Charity* of a *Christian*, or the *Civility* of a *Gentleman* ; And yet I did no more at first, but signify to my *Affailant*, in a very *modest* and *mild* Letter, That I supposed he did not judge of me in his *cold* and *considerate* thoughts, according to all that *severity* he vented in the *heat* of *Passion*, upon the account of which, I was ready to pass by those undeserved *vehementcies* of *Expression*, and to entertain a *civility* and *respect* for him.

Preface.

him. This *Letter* the **Grave Man** received, but never returned me any *Answer*, but what I had from *Publick Fame*, which brought me daily notice of his declaring me an **Atheist** in all *Places* and *Companies*. These *foul indignities* for a while I thought my self obliged to bear *meekly*, as became a *Christian*, and one that taught others *Patience*; and accordingly sate down quietly under the *infamy* of that *Tongue*, expecting when it would have spent its *fury*, and have done: But it was not content to *vilifie* me *abroad*, but come into my *Parish* to wound me *nearer*, and affixt on me the same *horrid* imputation, before some of the *People* of my *Charge*; as if my *Persecuter* had designed, not only to *undo* my *Reputation*, but also to defeat the *Success* of my *Labours*.

These *Carriages* I thought very
strange.

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strange, and very unbecoming one who Preacheth that Charity that thinketh no Evil; and yet still I bore, and did not repay in kind, hoping that Time and greater matters would at last have taken off the fierce Assailant from the persecution of my Name: But it seems the Gentleman could find nothing else so powerfully to ingage his Thoughts; and therefore he multiplied Stories, and set his Invention on work, when Matter failed. He gave out, That my **LORD BISHOP** had writ him a Gratiulatory Letter for his egregious Vindication of the Scriptures against me, and had also reprobated my Atheism and Infidelity, in another. I was glad he spoke good things of our Reverend Diocesan, though at my Cost: but knew, as to what concerned my self, that it was the overflowing

Preface.

ing of his *good-will* towards the *Bi-
shop*, who never spake or writ a
word to me of any such matter. And
for the *other part*, I ask'd his *Lord-
ship*, and he was pleased to assure me,
that he never understood any thing
of such a Business, before my inqui-
ry. Besides which, he storied, as I
am credibly informed, That I had
sent him a **Recantation** (for that
interpretation he made of the *respect*
of my Letter) And if it had been
so indeed, he hath much added to
the credit of his own *Ingenuity* and
Veracity, in publishing me for *that*,
which he saith I have *retracted* and
disowned.

When therefore I saw, that a *little
Truth*, which gave the colour and
occasion, and a great deal of what
was not so, for which there was no
reason, were set on work to bespat-
ter and traduce me; When I percei-
ved

Preface.

ved that my *Patience* was abused, and my *Civility* made an *Argument* of *Cowardice* and *unmanly Compliance*; When I saw my *Name* exposed (for which I ought to have a concernment upon another account, besides that of *Self-love*) and the *Effect* of my *Ministry* like to be hindred by my *silence* and *tameness* under those *Pe-proaches*; I thought it a *duty* both to my self, and those of my Charge, to give *Publique Accounts* of the whole Matter, that they who are capable of judging, may see how little cause some men have for their *railing Insultations* and *Triumphs*.

I therefore resolved to prepare a *Letter*, I had writ to a private Friend about it, for the *Publick*; and I have in such a way ordered my *Castigations*, that they make up a *Discourse* upon a very *seasonable* and *general Subject*: So that my *Assailant* hath
B only

Preface.

only given the occasion of the *Method*. And so tender I am of troubling others with my *personal Matters*, that I suffered my thoughts several times to *cool*, and should perhaps have *reduced* my mind to an idle *indifferency* under those former *Slanders*, had not my **Reverend Adversary** taken care to *quicken* the *laziness* of my *Humour*, and to *warm* my intentions of proceeding, by the *continued abusive liberty* of his *Language*; the report of which, daily coming to my ears in *fresh gusts* as I was writing, did I confess excite in me a great *contempt* of that kind of *Spirit*, and occasioned me to express less *deference* and *respect*, than otherwise I should have done to this **Assailant**. This I mention for your *pardon*, because of his *Profession*; the consideration of which indeed did urge me sometimes to *more indignation*,

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tion, when I reflected, how unlike such rough, injurious demeanour was, to what may be expected from those that Minister in the Gospel of Peace and Love. So that though I am one that resent a certain ungentility (besides the other unhandsom things) in bitterness of Expression, yet I thought smartness of reproof to be here necessary and seasonable. And whoever shall consider the mild carriage of my Pen, when 'twas ingaged in a Defence of one of my Books, against the Assault of the Famous ALBINS, will see there, that I use it not as an Offensive Weapon of War, and that my Humour is not fierce and abusive. I therefore crave your candour in those Periods, where I may seem less smooth to my angry Antagonist; for I think it not proper to Complement, when he Strikes. And yet I am not at eye for

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eye, and tooth for tooth; nor do I study *strict retribution*: But having a great *Aversion* in my *Nature* and my *Principles*, to the **rude, disputing, censorious, and implacable Spirit**, cannot forbear giving my *Style* a *tincture* of the *disesteem*, not to say *contempt*, I have for *that Genius*.

I had here added some other things, which I thought fit for your notice, concerning the *Matter* of the *black Charge*; and such as I conceive will help me to a better place in your thoughts, than the **Disputer** would provide for me: But those *Considerations* would have swell'd this *Preface* to a *disproportionate bulk*; and therefore I have cast them into the latter end, where I hope you will take the pains to find them, and do me, and others that may be concerned, *that right*, as to weigh deliberately those *Apologetical Remarques*.

And

Preface.

And having signified this my desire, I proceed to observe what more nearly relates to the main Subject of the *Discourse* it self, the *chief design* of which is, to encourage the *freer* and *better* disposed Spirits, to *vigour* and *endeavour* in the *pursuits* of *Knowledge*; and to raise the *capable* and *ingenuous*, from a *dull* and *drowsie* *acquiescence* in the *Discoveries* of former *Times*; by representing the great *Encouragements* we have to proceed, from *modern Helps* and *Advancements*. Of these I have given some *Instances* in the more *remarkable Particulars*: For I intend not a *full* and *accurate History* of all the late *Improvements* of *Science*; but so much as may serve my aim of confuting the *fond* Saying of my *Antagonist*, and exciting of *Philosophical Endeavours*. In which, I confess, I had a principal eye upon the *ROYAL SOCIETY*,

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and the Noble Purposes of that *Illustrious Assembly*, which I look upon as the great ferment of *useful and generous Knowledge*; and have said enough, I think, to justify *that Apprehension*, in the following Sheets. And because some *pious men* are afraid of an *Institution* they have heard but imperfectly of, and are *jealous* of what they have not had opportunities to understand, I have therefore given a *succinct Account* of the *Reason, Nature, and Designs* of *that Establishment*, for the information of such as have not met with their *Excellent HISTORY*. Besides which, I think fit to add here, That *WE* of the *CLERGIE* have no reason to apprehend danger from that *Constitution*, since so many *Pious, Learned, and Excellent Persons* of our Order, are *Members* of *that Body*. And for the prevention
of

Preface.

of those panick, causeless Terrours, I shall take the boldness here to name some of those Venerable and Worthy Ecclesiasticks. I find therefore in their Catalogue, The Most Reverend the Lords Archbishops of CANTERBURY and YORK, The Right Reverend the Lords Bishops of ELY, LONDON, ROCHESTER, SARUM, WINTON; and those other Reverend Doctors, Dr. John Wilkins Dean of RIPPON, Dr. Edward Cotton Archdeacon of CORNWALL, Dr. RALPH BATHURST President of Trin. Coll. OXON. Dr. John Pearson Margaret Professor of CAMBRIDGE, Dr. John Wallis Professor of Geometry in OXFORD, Dr. William Holder, Dr. Henry More, Dr. John Pell; and I reserve for your nearer notice, an excellent Person of your Neighbourhood and Number,

Preface.

Dr. John Beale, who in an Age that usually cools and sinks, as to the more active Designs, doth yet retain the vigour and vivacity of sprightly youth, with the judgement of the ripest years, and is unwearied in the noblest Activities and most generous Prosecutions.

And now I hope that there is none of you guilty of so great an immodesty and irreverence, as to judge those Designs to have an evil Aspect upon Religion, which are subscribed and promoted by so many great and grave Divines, of such known Piety and Judgment. And the mention of those Celebrated Names, may serve to remove another groundless suspicion which some have entertained, viz. That the Universities are undermined by this new Philosophick Society: For whoever phancieth or suggests that, casts a black Character upon

Preface.

upon the *sagacity* and *faithfulness* of those *Reverend Men*, who all have been *Eminent Members* of one or other of those *Schools of Learning*; and most of them do still retain a *Relation* to those *ancient* and *venerable Bodies*.

But to supersede further Discourse about this here, I owe some things else to my self, which is to answer the *Objection*, of my opposing the great Name of *ARISTOTLE*. Concerning it, I have said *some things* in this *Book*, and *more* in *others*; For the present therefore I shall content my self to suggest, That I am very ready to give chearful Acknowledgements to his *Rhetorick*, *History of Animals*, and *Mechanicks*, and could wish that these were more studied by his *devoted Admirers*: But for the *notional* and *disputing* parts of his *Philosophy*, it hath deeply

Preface.

ly troubled me, when I have considered how much they have taken up that Time, and those Endeavours, which should have been imployed in surveying the *Works* of *GOD*, that magnifie and discover their *Author*, from which only the *true Philosophy* is to be obtained: And the zeal I have for the *Glory* of the Almighty discovered in his *Creatures*, hath inspired me with some smartness and severity against those *Heathen Notions* which have so unhappily diverted Learned men from the study of *Gods GREAT BOOK, UNIVERSAL NATURE*; and consequently, robb'd *Him* of that *Honour*, and those *Acclamations* that are due to him, for those admirable Results of his *Wisdom* and *Goodness*.

And now 'tis high time to draw up to the last Requests I have to
You,

Preface.

You, which are, That you would please to do me that right, *deliberately* to weigh my following accounts, which though I have designed to express with all imaginable *perspicuity* and clearness, yet I cannot expect that they should presently enter into Minds, that most ordinarily converse with another sort of Matters, upon an *hasty* and *careless perusal*. I say therefore, I appeal to the *reflecting* and *considerate* thoughts of *attentive* and *judicious* men, But for the hair-brain'd half-witted Censurers, that only tell the Leaves of Books, and pass *Definitive Sentences* at a venture, I except against their *Verdicts*, and condemn them.

You see upon the whole, that I have dealt *openly* with my **Antagonist**, and have said all to himself and the Publick, and more than ever I did on any private occasion :
Though

Preface.

Though I believe, that *he* that hath endeavoured *skulkingly* and by *envious Arts* to traduce me, would be ashamed to own *that* in the face of the light, and mine, which he hath reported in corners. Whether he intends to answer my *Relations* and *Reflections*, or sit down in a **grave silence**, I cannot tell. If he doth the former, I look that he should shew, *either that there are no such Instances of Improvement in Knowledge, since Aristotle, as I have reckoned; or, That they are no Advantage for the Increase of SCIENCE.* If he proves either of these, his *Return* will be an *Answer*; and I shall admire his *Wit* in an eternal respect and silence: But if he offers any thing else for

a

Preface.

a Reply, I appeal to you, whether it be like to be to purpose? or, whether I shall have any need to trouble my self to rejoyne to an *impertinence*? But on the other hand, if his **Sageness** resolve to sit down, and gravely to say nothing in Return (which 'tis like his Wisdom will counsel him to be best) I expect from such an *Ingenuity* as his, that he should fall again to his little arts of *Calamny*, and deal with my Book as he hath with my Person, assault it *behind* with dirt and hardnames, and confute it with a *Pish*, or a great word or two, among his private Admirers. This no doubt will be the easiest way of Answering; and those that have got great Reputation by **Artifice**, **Chance**, **Uaupouring**, or the **Ignorance** of those they converse with, have commonly the *prudence* not to put it to the hazard of publick Tryals. I do
not

Preface.

not say, this is the Case of the **Reverend Disputer**; let those that know, judge.

However 'tis, my Antagonist being of long standing in these Parts, is like to have the *wind* here; and whether his *Reply* be *publique* or not, I reckon he will blow the **DUST** upon me: but if I have the **SUN**, as I hope, I shall have no reason to regret his Advantage. The Truth is, I desire to conflict in an open *Champaigne*, where there may be less danger of *guile*, *treachery*, and *ambush*: But I perceive my Adversary is for fighting in **Dirty-lanes** and among the **Cole-pits**, like the *Irish* among their *Boggs*. Let him enjoy the *Empire of Learning* in those Places, and whatever *Triumphs* over me he pleaseth. If **YOU**, Sirs, and the intelligent World favour the *Justice* of my Cause, which, without

Preface.

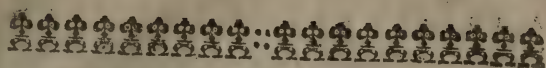
out disparagement to *yours* I cannot doubt, I have enough, and shall be content to permit the **Disputer** to clap his *Wings*, and *crow* at home, till he be *ashamed* and weary of his *fond* and *causeless Orations*.

These are the things I thought fit to premise to my *Discourse*, to which now I remit your *Eyes*, without adding more, but the *Respect* and *Service* of,

Reverend Sirs,

Your humble Honourer and
Servant,

J. G.



Modern Improvements
OF
USEFUL KNOWLEDGE:

To a Friend.

CHAP. I.

The INTRODUCTION.

SIR,

THE *Inquiry* of your last was very
obliging, as it signified an *affectionate*
concernment for me: And in
testimony of my resentment of the Kind-
ness, I shall be *large* and *particular* in my
Return; which I intend as full as my Af-
fairs will permit, because I owe you some
Account of the *Modern* way of *Philosophy*,
and the *ROYAL* Colledge of *Philosophers*:
And

2 *Modern Improvements*

And I do not yet know, but that I may have an occasion of making these things publick. Not that I am so fond to think my *little Contrasts* fit subject for general Entertainment; nor am I so tender and over-weening, as to make it a *business* to complain in Print of my private Injuries; But I foresee, the *Relation* I am about will afford me fit and ample opportunity to discourse things, which perhaps you may think worth your labour to *consider*. And what I have to say, tends either to the direct recommendation of the ways of *Useful Knowledge*, or to the detecting the *immorality, weakness, and vanity* of the *Spirit* that opposeth it.

Briefly then, as to your Inquiry about the Conference I had with the **Grave Person** you mention; You may please to know, That not long since I lighted into the Company of that *Reverend Man*, who, I suppose you have heard, hath a Reputation for Learning among his *Neighbours*, and is accounted a **Philosopher** in the **Peripatetick way**. I was glad of an opportunity of his Acquaintance, and approach'd him with that respect which I judged due to a person of that *Gravity*, and of whom I had heard *advantageously*.

He

of Useful Knowledge. 3

He had been speaking before I came, about *Aristotle* and his *Philosophy*; And after our first Civilities were over, he renewed the Discourse, and applied it all to me. I confess I was not willing to begin an Acquaintance in a *Dispute*, in which I foresaw there might be danger of *heat* and *animosity*. This I intimated, and would have declined the occasion; because, though I love *modest* and *temperate* Discourfing, yet I am a profess'd Enemy to all *captious* and *resolv'd* *Oppositions*, which for the most part run into *wild Rambles*, and end in *Quarrels*. But the Gentleman, it seems, had warm'd himself by the concernment he took in the Discourse, and was forward to prosecute the Argument in *vindication* and *praise* of *Beloved Aristotle*: Which Carriage, though I thought somewhat too young for the *Gravity* of that *Appearance*, and more becoming the *pertness* of a *Sophister*, than the *Sageſs* of a *Reverend Divine*; yet I abstain'd from any *displeaſing Reflection*, and ſhould quietly have permitted him to have ſatisfi'd himself in his *Venerations* of that *Name*, without interruption or diſturbance: For I count it not *civil* to trouble any One in his *worſhip*, or to profeſs to his face, a *contempt* of another Mans *G O D S*.

4 Modern Improvements

But the **Grave** Gentleman could not be content only to celebrate and admire his *Aristotle*; but was pleased to take an occasion to make *Comparisons*, and to *diminish* the **ROYAL SOCIETY**. This Passage, I confess, I thought not handsome. And methinks the *Reverence* we owe to the **ROYAL FOUNDER** and **PATRON** of that *Etablissement*, and the Respect that is due to **PRINCES**, **PRIVATE COUNSELLORS**, and **PRELATES**; to the most *Learned* Men of all Sorts and Professions, *Mathematicians*, *Chymists*, *Physicians*, *Anatomists*, *Antiquaries*, and *Philosophers*; to the **PRIME NOBILITY**, and so many of the *Learned* and *Ingenious* amongst the **GENTRY**: I say, I thought that the Regard, which is a debt to such Persons as make up that *Honourable Assembly*, had been enough to procure it *Civil usage* among all that had but an *indifferent* proportion of *Modesty* and *Breeding*. And if there were nothing else to oblige men to Respectful Discourse of this *Generous Company*, I should think the Consideration of their Noble Aims, which no doubt are some of the *Greatest*, most *August*, and most *Hopeful* that ever were, should be sufficient to obtain them at least
good

of Useful Knowledge. 5

good words from all that are capable of understanding their *Catholick* intendments and prosecutions. And these, Sir, are not the little Projects of serving a *Sect*, or propagating an *Opinion*; of spinning out a *subtile Notion* into a *fine thred*, or forming a *plausible System* of new *Speculations*: but they are *Designs* of making *Knowledge Practical*, and *accommodating Mankind* in things of *Universal Benefit*, by searching into the *Creatures* of God as they are in his *World*, and not *criticizing* upon the *Images* of them as they lye in *that* which the *Phansies* of *Men* have *contriv'd*. This my Reverend *Assailant* either did *not know*, or did *not consider*. But supposing that this *Society* had a design against *adored Aristotle*, or not so great an apprehension of him as he had been wont to instil into his *Pupils*, thought fit to bring it under his *Corrections*; and at his disrespectful Discourse of that *Assembly*, I felt my self concerned.

I therefore took occasion to speak from somewhat he had newly said, which was to this purpose, [**That Aristotle had more Advantages for Knowledge than the ROYAL SOCIETY or all the present Age had, or could have**; and for this *strong Reason*,
C 3 because

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because he did totam peragrarè Asi-
am.] This, Sir, you perceive was said in
haste, when *Consideration* was not at home.
And I was much surpris'd to hear an Asser-
tion from one that had not lived in a Cell,
which were scarce excusable in a *Recluse*,
who had seen or known nothing of the
World, but the *Antique Venerable Images*
of a *Religious House*. And you will be
sensible of the *injustice* and *incogitancy* of
this saying, and conceive better things of
the later Ages, when you reflect and think
how many *Arts, Instruments,*
Observations, Experiments,
Inventions and *Improvements,*
have been disclosed to the World since the
days of *Aristotle*, which are vast *Ad-*
vantages for *Knowledge*, and
all *Noble* and *Useful Inquiries*.

But before I come to instance in these
Particulars, I must premise, That the
ROYAL SOCIETY, and those of that
Genius, are very ready to do right to the
Learned Ancients, by acknowledging their
Wit, and all the *useful Theories* and helps
we have from them: but they are not wil-
ling

of Useful Knowledge. 7

ling that *those*, however *venerable Sages*, should have an *absolute Empire* over the *Reasons of Mankind*. Nor do they think, That all the *Riches of Nature* were discovered to some *few particular Men* of former Times; and that there is nothing left for the *benefit and gratification* of after-Inquirers. But *They* believe, There is an *inexhaustible variety* of *Treasure* which *Providence* hath lodged in Things, that to the *Worlds end* will afford *fresh Discoveries*, and suffice to reward the *ingenious Industry* and *Researches* of those that look into the *Works of God*, and go down to see his *wonders in the deep*. This, no doubt, the *modesty* and *justice* of the *Ancients* themselves would have confess'd. But besides this, the *Modern Experimenters* think, That the *Philosophers* of elder Times, though their *wits* were excellent, yet the way they took was not like to bring much *advantage* to *Knowledge*, or any of the *Uses of humane Life*; being for the most part *that* of *Notion and Dispute*, which still runs round in a *Labyrinth of Talk*, but *advanceth nothing*. And the *unfruitfulness* of those *Methods of Science*, which in so many *Centuries* never brought the World so much *practical, beneficial Knowledge*, as would help towards

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the Cure of a *Cut finger*, is a palpable Argument, That they were *fundamental Mistakes*, and that the *Way* was not *right*.

For, as my Lord Bacon observes well, *Philosophy*, as well as *Faith*, must be *shewn* by its *works*. And if the *Moderns* cannot shew more of the *works* of their *Philosophy* in *six years*, than the *Aristoteleans* can produce of *theirs* in more than *thrice* so many *hundred*, let them be loaded with all that *Contempt* which is usually the *reward* of *vain* and *unprofitable Projectors*. But now, That this *Procedure* hath effected more for the *information* and *advantage* of Mankind, than all the *Agcs* of *Notion*, the *Records* of the *Royal Society* alone are a sufficient Evidence (as the *World* will see, when they shall think fit to unfold their *Treasure*.) I say then, the *Modern Philosophers* arrogate nothing to their own *Wit*, above that of the *Ancients*: but by the *reason* of the *thing*, and *material*, *sensible Events*, they find they have an advantage by their *way*. And a *lame Child* that *slowly* treads the *right Path*, will at last arrive to his *Journeys end*; while the *swift Footman* that *runs* about in a *wood*, will lose himself in his *wandrings*.

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CHAP. II.

The Ways of improving Useful Knowledge proposed. The Advantages this Age hath from the great advancements of Chymistry and Anatomy,

AND having said *this*, I come to encourage your *hopes* in the *present Philosophical Endeavours*; and to discourse more *largely*, what I could but suggest to the **Reverend Disputer**. And here I am to represent in as many material *Particulars* as I can now call into my thoughts, the *Advantages* for *Useful Knowledge*, which the *later Ages* have beyond *those* of the days of *Aristotle*, and *remoter Antiquity*. And in order to this, I consider,

That there are *Two* chief ways whereby *Knowledge* may be *advanced*, viz. (1.) By enlarging the *HISTORY* of Things: And (2.) By improving *INTERCOURSE* and *COMMUNICATIONS*. The *HISTORY* of Nature is to be *augmented*, either by an *investigation* of the *Springs* of *Natural Motions*, or *fuller Accounts* of the

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the grosser and more palpable Phenomena. For the searching out the *beginnings* and *depths* of Things, and discovering the *intrigues* of *remoter* Nature, there are **THREE** remarkable **ARTS**, and multitudes of excellent **INSTRUMENTS**, which are great Advantages to these *later Ages*; but were either not at all known, or but *imperfectly*, by *Aristotle* and the *Ancients*. The **ARTS** in which I instance, are **CHYMISTRY**, **ANATOMY**, and the **MATHEMATICKS**: The **INSTRUMENTS**, such as the **MICROSCOPE**, **TELESCOPE**, **THERMOMETER**, **BAROMETER**, and the **AIR-PUMP**: Some of which were *first Invented*, all of them exceedingly *Improved* by the **ROYAL SOCIETY**.

TO begin with the Consideration of the **ARTS** mentioned, I observe, That *these* were very little cultivated or used in *Aristotles* Times, or in *those* following ones in which his *Philosophy* did most obtain.

For the **FIRST**, **CHYMISTRY**, it hath indeed a pretence to the great **Hermes** for its *Author* (how *truly*, I will not dispute) From *him* 'tis said to have

of Useful Knowledge. II

have come to the *Egyptians*, and from them to the *Arabians*; Among these it was infinitely mingled with *vanity* and *superstitious devices*: but it was not at all in use with *Aristotle* and his *Seētators*. Nor doth it appear that the *Grecians*, or the *disputing Ages*, were conversant in these *useful* and *luciferous Processes*, by which *Nature* is *unwound*, and *resolv'd* into the *minute Rudiments* of its *Composition*; and by the *violence* of those *Artful Fires* it is made *confess* those *latent* parts, which, upon *less provocation*, it would not *disclose*. And now, as we cannot understand the *frame* of a *Watch*, without taking it into *pieces*; so neither can *Nature* be well *known*, without a *resolution* of it into its *beginnings*, which certainly may be best of all done by *Chymical Methods*. And in those *vexatious Analyses* of Things, *wonderful discoveries* are made of their *Natures*, and *Experiments* are found out, which are not only full of *pleasant surprise* and *information*, but of *valuable use*, especially in the *Practice* of *Physick*; For It directs *Medicines* less *loathsome* and far more *vigorous*, and freeth the *Spirits*, and *purser* parts, from the *clogging* and *noxious appendices* of *grosser matter*, which not only *hinder* and *disable* the

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the *Operation*, but leave hurtful *dregs* in the *Body* behind them. I confess, Sir, that among the *Egyptians* and *Arabians*, the *Paracelsians*, and some other *Moderns*, *Chymistry* was very *phantastick*, *unintelligible*, and *delusive*; and the *boasts*, *vanity*, and *canting* of those *Spagyrist*s, brought a *scandal* upon the *Art*, and exposed it to *suspicion* and *contempt*: but its late *Cultivators*, and particularly the *ROYAL SOCIETY*, have refin'd it from its *dross*, and made it *honest*, *sober*, and *intelligible*, an excellent *Interpreter* to *Philosophy*, and *help* to *common Life*. For they have laid aside the *Chrysopoietick*, the *delusory Designs* and *vain Transmutations*, the *Rosie-crucian Vapours*, *Magical Charms*, and *superstitious Suggestions*, and form'd it into an *Instrument* to know the *depths* and *efficacies* of *Nature*. This, Sir, is no small advantage that we have above the *old Philosophers* of the *Notional way*. And we have another,

(2.) In the *Study*, *Use*, and *vast Improvements* of *ANATOMY*, which we find as needful to be *known* among us, as 'tis wonderful 'twas *known* so little among the *Ancients*, whom a fond *Superstition* deterr'd from *Dissections*. For the *Anatomizing* the *Bodies* of *Men*, was counted *barbarous*

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barous and inhumane in elder Times : And I observe from a Learned Man of our own, That the Romans held it unlawful to look on the Entrails. And Tertullian severely censures an Inquisitive Physician of his time, for this practice, saying, That he hated Man, that he might know him. Yea, one of the Popes (I take it 'twas Boniface 8.) threatens to Excommunicate those that should do any thing of this then-abominable nature. And Democritus was fain to excuse his Dissection of Beasts, even to the great Hippocrates. Nor does it appear by any thing extant in the Writings of Galen, that that other Father of Physicians ever made any Anatomy of humane Bodies. Thus shie and unacquainted was Antiquity with this excellent Art, which is one of the most useful in humane Life, and tends mightily to the eviscerating of Nature, and disclosure of the Springs of its Motion. But now in these later Ages, Anatomy hath been a free and general Practice; and particularly in this it hath received wonderful Improvements from the Endeavours of several worthy Inquisitors, some of them Ingenious Members of the ROYAL SOCIETY, as Sir George Ent, Dr. Glisson, and Dr. Willis. I instance in the most remarkable of their Discoveries

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Discoveries briefly; And those I take notice of are, The *Valves* of the *Veins*, discover'd by *Fabricius ab Aquapendente*; The *Valve* at the entrance of the gut *Colon*, found, as is generally thought, by *Bauhinus*; The *Milkie Veins* of the *Mesentery*, by *A-fellius*; The *Receptacle* of the *Chyle*, by *Pecquet*; and the *Lactea Thoracica*, by the same Discoverer; The *Glandula Lactea Lumbaris*, by *Bartholin*; A new *Ductus* in the *Testicles*, by *Dr. Highmore*; The *Ductus Virsungianus*, by *Jo. George Wirsung* of *Padua*; The *Lymphatick Vessels*, by *Dr. Joliffe*, *Bartholin*, and *Olaus Rudbeck*; The internal *Ductus Salivaris* in the *Maxillary Glandule*, by *Dr. Wharton*, and *Dr. Glisson*; The external *Ductus Salivaris* in the conglomerated *Parotis*, The *Ductus* of the *Cheek*, The *Glandules* under the *Tongue*, *Nose*, and *Palate*, The *Vessels* in the nameless *Glandule* of the *Eye*, and the *Tear-Glandule*, by *Nich. Steno*; The *Sinus* of the *Veins*, and their *Use*, by *Dr. Willis*; The *Ductus Renales*, by *Laurentius Bellini*; A new *Artery*, called *Arteria Bronchialis*, by *Fred. Ruysch*. I add, the *Origination* of those *Nerves* which were of old supposed to arise out of the substance of the *Brain*, but are found by late *Anatomists* to proceed from the *Medulla Oblongata*.

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Oblongata. And though the *Succus nutritius* be not yet fully agreed upon by *Physicians*, yet it hath so much to say for it self, that it may not unreasonably be mentioned among the *New Inventions*.

But of all the *modern Discoveries*, *Wit* and *Industry* have made in the *Oeconomy* of *humane Nature*, the Noblest is that of the *Circulation* of the *Blood*, which was the *Invention* of our deservedly-famous *Harvey*. 'Tis true, the *Envy* of *malicious* *Contemporaries*, would have robb'd him of the *Glory* of *this Discovery*, and pretend it was known to *Hippocrates*, *Plato*, *Aristotle*, and others among the *Ancients*: But whoever considers the *Expressions* of those *Authors*, which are said to respect the *Circulation*, will find, that those who form the *Inference*, do it by a *faculty* that makes all *kind* of *Compositions* and *Deductions*, and the same that assists the *Enthusiasts* of our days to see so clearly all our *Alterations* of *State* and *Religion*, to the *minuteſt Particulars*, in the *Revelation* of *St. Fohn*. And I think it may be as well concluded from the *first Chapter* of *Genesis*, as from the *Remains* of those *Ancients*; who, if they had known this great and *general Theory*, how chance they spake no more of a thing, which no doubt

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doubt they had frequent occasions to mention? How came it to be *lost* without memory among their Followers, who were such *superstitious porers* upon their Writings? How chance it was not shewn to be lodg'd in those Authors, before the days of Dr. *Harvey*, when *Envy* had impregnated and determined the *Imaginations* of those, who were not willing any thing should be found anew, of which themselves were not the *Inventors*? But 'tis not only the *remotest* Ancients, whom time hath consecrated, and distance made venerable, whose *Ashes* those fond men would honour with *this Discovery*: but even much later Authors have had the glory fastned upon them. For the *Invention* is by some ascribed to *Paulus Venetus*; by others, to *Prosper Alpinus*; and a third sort give it to *Andreas Casalpinus*. For these, though either of them should be acknowledged to be the Author, it will make as much for the design of my Discourse, as if *Harvey* had the credit; and therefore here I am no otherwise concerned, but to have *Justice* for that Excellent Man: And the World hath now done *right* to his *Memory*, *Death* having overcome that *Envy* which dog's *living Virtue* to the *Grave*; and his *Name*
rests

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rests quietly in the Arms of *Glory*, while the *Pretensions* of his *Rivals* are creeping into *darkness* and *oblivion*.

Thus, Sir, I have done with the *Instances* of *Anatomical Advancements*, unless I should hitherto refer the late Noble *Experiment* of *Transfusion* of the *Blood* from one *living Animal* into another, which I think very fit to be mention'd; and I suppose 'tis not improper for this place: Or however, I shall rather venture the danger of *impropriety* and *misplacing*, than omit the taking notice of so excellent a *Discovery*, which no doubt future *Ingenuity* and *Practice*, will improve to purposes not yet thought of; and we have very great likelihood of *Advantages* from it in *present prospect*.

For it is concluded, That the greatest part of our *Diseases* arise either from the *scarcity*, or *malignant tempers* and *corruptions* of our *Blood*; in which cases *Transfusion* is an *obvious Remedy*; and in the way of this *Operation*, the *peccant Blood* may be drawn out, without the danger of too much *enfeebling Nature*, which is the grand inconvenience of *meer Phlebotomies*. So that *this Experiment* may be of excellent use,

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when

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When *Custom* and *Acquaintance* have hardened men to permit the Practice, in *Pleurisies*, *Cancers*, *Leprosies*, *Madness*, *Ulcers*, *Small-Pox*, *Dotage*, and all such like Distempers. And I know not why *that* of *injecting prepared Medicines* immediately into the Blood, may not be better and more efficacious, than the ordinary course of Practice: Since this will prevent all the danger of frustration from the *loathings* of the *Stomach*, and the disabling, clogging mixtures and alterations they meet with *there*, and in the *Intestines*, in which no doubt much of the *Spirit* and *Virtue* is *lost*. But in the way of *immediate injection*, they are kept *intire*, all those inconveniences are avoided, and the *Operation* is like to be more *speedy* and *successful*. Both these *noble Experiments* are the late *Inventions* of the *ROYAL SOCIETY*, who have attested the *reality* of the former, *that* of *Transfusion of Blood*, by numerous Tryals on several sorts of *brute Animals*. Indeed the *French* made the *Experiment* first upon *humane Bodies*, of which we have a good account from *Monfieur Dennis*: But it hath also since been practiced with fair and encouraging success, by our *Philosophical Society*. The *other* of *Injection*, if it may be

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be mentioned as a different Invention, was also the product of the same *Generous Inventors* ; though indeed more *forward Foreigners* have endeavoured to *usurp* the credit of both. This latter likewise hath succeeded to considerable good effects, in some *new Tryals* that have been made of it in *Dantzick*, as appears in a Letter written from *Dr. Fabritius* of that City, and printed in the *Philosophical Transactions*.

CHAP. III.

Another great Advantage of late Times, from the Improvements of Mathematicks ; particularly of Arithmetick, Algebra, and Geometry, discours'd by Instances.

I Proceed now to my *THIRD Instance* of *ARTS* (if the *Reverend Logician* will give me leave to use the word in this large sense) which are *Advantages* for deep search into Nature, and have been considerably advanc'd by the *Industry* and culture of *late Times*, above their an-

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cient Stature. And the Instance was,
 (III.) *THE MATHEMATICKS.*
 That these are mighty helps to *practical*
 and *useful Knowledge*, will be *easily* confest
 by all, that have not so much *ignorance* as
 to render them *incapable* of information
 in these matters. And the Learned *Ger-*
ard Vossius hath proved it by *induction* in
 particulars. And yet it must be acknow-
 ledged that *Aristotle*, and the *disputing Phi-*
losophers of his School, were not much ad-
 dicted to those *noble Inquisitions*: For *Pro-*
clus the *Commentator* upon *Euclide*, though
 he gives a very particular Catalogue of the
Elder Mathematicians, yet hath not menti-
 oned *Aristotle* in that number. And though
Diogenes Laertius takes notice of a Book he
 inscribed Μαθηματικόν, another, Περὶ μυστικῶν,
 and a Third, yet extant, Περὶ ἀτόπων γεγεμῶν;
 Yet it appears not that these were things of
 very great value; and *Aristotle's Metaphy-*
sical procedure, even in *Physical Theories*, the
genius and *humour* of his *Principles*, and the
airy contentions of his *Sect*, are huge pre-
 sumptions that *this Philosopher* was not very
Mathematical. And his numerous suc-
 ceeding Followers, were certainly very lit-
 tle conversant in those *generous Studies*. I
 have elsewhere taken notice, that there is
 more

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more publish'd by those *Disputing men* on some paultry trifling Question about *ens Rationis*, and their *Materia prima*, than hath been written by their whole number upon all the *vast* and useful parts of *Mathematicks* and *Mechanicks*. There was a time when these were counted **Coniurations**; and I do not very well know the reason of the **Reverend Disputers** displeasure at my Discourse about **Diop-trick Tubes** (of which you will hear in the process) except he was under the dread of some such *phantie*, and believed there was **Magick** in *Opticks*. It would require much skill in those *Sciences*, to draw up the full *History* of their *Advancements*; I hear a very accurate *Mathematician* is upon it: And yet to fill up my Method, I'll adventure at some imperfect Suggestions about the *Inventions* and *Improvements* of this kind: And I begin,

(I.) With *ARITHMETICK*, which is the handmaid to all the other parts of *Mathematicks*. *This* indeed *Pythagoras* is said to have brought from the *Phœnicians* to the *Græcians*: but we hear no great matter of it till the days of *Euclide*: not the *Euclide* that was the *Contemporary* of *Plato*,

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and Hearer of *Socrates* ; but the famed *Mathematician* of that Name, who was after *Aristotle*, and at 90 years distance from the former. This is the first Person among the Ancients, that is recorded by the exact *Vossius* to have done any thing accurately in that Science. After him it was advanced by *Diophantus*, methodized by *Psellus*, illustrated among the *Latins* by *L. Apuleius*, and in later times much promoted by *Cardan*, *Gemma Frisius*, *Ramus*, *Clavius*, and divers more modern Artists, among whom I more especially take notice of that Ingenious *Scot* the Lord *Napier*,

Who invented the *Logarithmes*, which is a way of computing by artificial Numbers, and avoiding the tedium of *Multiplication* and *Division*. For by this Method all those Operations are performed by *Addition* and *Subtraction*, which in natural Numbers were to be done those longer ways. This Invention is of great use in *Astronomical Calculations*, and it may be applied also to other Accompts. Besides this, the same Learned Lord found an easie, certain, and compendious way of Accounting by Sticks, called *Rabdology*; as also Computation by *Napier's Bones*: Both these have

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have been brought to greater perfection by others, since their *first Discovery*; particularly by *Ursinus* and *Kepler*.

To them I add the *Decimal Arithmetick*, which avoids the *tedious* way of *computing* by *Vulgar Fractions* in ordinary *Accompts*, and *Sexagenaries* in *Astronomy*; exceedingly and lately improved by our famous *Oughtred*, and *Dr. wallis* a Member of the *ROYAL SOCIETY*. If I should here subjoyn the *Helps* this *Art* hath had from the *Works* and *Endeavours* of *Anatolius*, *Barlaam*, *Maximus Palanudes*, *Nemorarius*, *Florentinus Bredonus*, *Pisanus*, *Orentius*; and in *this Age*, from those of *Adrianus Romanus*, *Henischi*, *Cataldus*, *Malapartius*, *Keplerus*, *Briggius*, *Crugerus*, and a vast number reckon'd up by *Vossius*, I should be tedious on this Head; and therefore I pass lightly over it, and proceed,

(II.) To *ALGEBRA*, of *universal use* in all the *Mathematical Sciences*, in *Common Accompts*, in *Astronomy*, in *taking Distances* and *Altitudes*, in *measuring plain* and *solid Bodies*, and other *useful Operations*. The first noted Author in this Method was *Diophantus*, who lived long since the *Idol of Disputers*. He, and those other

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Ancients that used it, performed their *Algebraical Operations* by *Signs* and *Characters* suited to the several *Numbers*, and *powers* of *Numbers*, which they had occasion to use in *solving Problems*: But the later *Mathematicians* have found a far more neat and easie way, *viz.* by the *Letters* of the *Alphabet*, by which we can solve many *Problemes* that were too hard for the *Ancients*, as far as can be discovered by any of their remaining *Works*. For there were many *affected Equations* (as they call them) that did not *equally ascend* in the *Scale* of *Powers*, that could not be *solvd* by the *elder Methods*; whereas the acute *Vieta*, a *Mathematician* of this last Age, affirms, he could *resolve* any *Probleme* by his own *Improvements*. Besides him, our excellent *Oughtred* another, lately mentioned, did much in this way. But the inimitable *Des Cartes* hath vastly out-done both former and later Times, and carried *Algebra* to that height, that some considering men think *Humane Wit* cannot advance it further. I will not say so much: but no doubt he hath performed in it things deserving vast *acknowledgment*, of which you shall hear more anon. And from hence I stop, (III.) To

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(III.) To the Consideration of *GEOMETRY*, which is so *fundamentally useful* a Science, that without it we cannot in any good degree understand the *Artifice* of the *Omniscient Architect* in the composition of the *great World*, and *our selves*. $\Theta\epsilon\omicron\varsigma\ \tau\epsilon\omicron\mu\epsilon\tau\rho\epsilon\iota$, was the excellent saying of *Plato*; and the *Universe* must be *known* by the *Art* whereby it was *made*. So that what *Galileo* notes of *Aristotle*, is a great sign of his defects, *viz.* That he reprehended his Venerable Master for his *Geometrical Sublimities*, accusing him that he receded from the *solid Methods* of *Philosophizing*, through his too much indulging that Study; Which is so far from being likely, that *Geometry* is little less than absolutely necessary to *solid* and *real Philosophy*; and as I intimated, 'tis next to impossible to be a *judicious* and *accurate Philosopher*, and want it. Upon which account, *Plato* admitted none to his School, but those that were acquainted with that Science: Which practice the mentioned excellent *Modern*, notes to be directly opposite to the *Peripatetick* genius; and some he knew great men of that way, dehorted their Disciples from it; which he introduced

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duceth one applauding as a *wise* Counsel, since *Geometry* would detect and shame the *futilities* of that *Notional way*. But not to take too large a compass, this is certain, That *Geometry* is a most *useful* and *proper help* in the affairs of *Philosophy* and *Life*. 'Tis almost as clear from those former intimations, that *Aristotle* was not much enclined *that way*; and we know that his *late Sectators*, have very seldome applied themselves to *Geometrical Disquisitions*.

The Result of which is, We must expect the Advantages of this Science, from the declining of *his* and *their Empire*; and I need not say *expect* it, they are both in present view. And if after this you require accounts of the *Improvements* *Geometry* hath received, since the foundation of that *Tyranny* by the *Man* of *STAGYRA*, I shall offer you the best I have; and though I am conscious that they will be *scant* and *defective*, yet I hope *sufficient* for my present purpose.

I note then from the celebrated *Vossius*, That *Euclide* was the *first* that brought *Geometry* into a *Method*, and more *accurately demonstrated* those Principles, which before were scattered among the *Greeks* and *Aegyptians*, and not so *cogently* or *carefully* proved.

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proved. And *Proclus* reckons this *Famous man* as the *Compiler* and *Demonstrator*, not as the *Inventor* of the *Elements*; and two of these Books (*viz.* 14. & 15.) are ascribed to *Apollonius Pergaeus*, who was his nearest Successor in Fame for *Mathematical Abilities*. This *Geometrician* improved the Science by four Books of *Conicks*, publish'd of old; and three more have been lately (in the year 1661.) translated out of an *Arabick Manuscript* in the Duke of *Tuscany's Library*, and are now abroad. This *Manuscript* *Jacob Golius* procured out of the East. Besides which, this *Magnus Geometra*, as he was called, illustrated *Euclide* by his *Learned Commentary* upon him. But *Archimedes* of *Syracuse*, was a Person of the greatest renown for *Geometrical* and *Mechanical Performances*; concerning which, *Polybius*, *Valerius*, *Plutarch*, *Livy*, and others, have recorded prodigious things. This great wit carried *Geometry* from general and idle Speculation, to the use and benefit of Mankind; whereas before him it was an ancient and perverse Opinion, That this Knowledge ought not to be brought down to vulgar Service, but kept up in *abstractive Contemplations*: upon which score *Archytas* and *Eudoxus*, those great *Geometricians* before,

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before *Euclide*, were scared from the *Mechanical* and *Organical Methods*, to the great hindrance of *beneficial Improvements* in that way. But the excellent *Syracusan* understood, that *this Science* is not debased, but promoted and advanced by such *Accommodations*; and evinc'd the *usefulness* and *excellency* of *Geometry*, in his admirable *Paradox* proposed before King *Hieron* (*Datis viribus datum pondus tollere*) [$\Delta\delta\epsilon\ \mu\epsilon\iota\ \tau\omega\ \sigma\omega\ \eta\ \kappa\iota\upsilon\sigma\omega\ \tau\omega\ \gamma\omega$] This *Mathematician* flourish'd 160 years after the time of *Aristotle*, who hath the name of the most ancient that writ in *Mechanicks*, though that Book of his be not mentioned either by *Archimedes*, *Athenaeus*, *Hero*, or *Pappus*, *Mechanical Authors*; and *Cardan* and *Patricius* affirm that work to be none of *Aristotle's*: Whose ever it was, the *Performance* hath praise from the *Learned*, as explaining the *general Causes* of *Mechanical Geometry*. But *Archimedes* was more *practical* and *particular*: And though *Plutarch* in the *Life* of *Marcellus* affirms he writ nothing; yet the contrary is abundantly proved by *Gerard Vossius*, who hath shewn that the Books extant under his Name, that contain so many great *Maxims* of *Mechanicks*, are *genuine*; and both *Strabo* and *Pappus* mention

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tion them as *his*. The Design of *Archimedes*, of combining *Mechanism* and *Geometrick Theory*, was after happily promoted by *Hero* the Elder of *Alexandria*, who invented those *ingenuous Automata*, that move by *Air* and *Wyres*; concerning which he writ a Book that was Translated by *Fredericus Commandinus*, as also he did another *De Machinis Bellicis*, by which he well improved *Geometrick Mechanicks*: And *Pappus* particularly celebrates his exactness in solving the *Deliaick Problem*, *De Cubo duplicando*, acknowledging that he took most of his own Accounts about that matter, from that exquisite *Man*. Next him, I mention *Theodosius* of *Tripoli*, who very much improved *Geometry* by his three Books *De Figura Spherica*, which afforded great assistance to *Ptolomy*, *Pappus*, *Proclus*, and *Theon*, in their *Mathematical Endeavours*. *Mennelaus* also, who lived in *Trajan's* time, contributed very much to the perfecting the Doctrine of *Sphericks*, as *Vitellio* well knew, who was famous for those things which he borrowed from that Author. The Performances also of *Ctesibius*, who lived in the time of *Ptolomeus Physcon*, are much celebrated by *Pliny*. He invented many things in *Hydraulicks*, and according to
Athenaus,

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Athenaus, he was the first Contriver of *Musical Organs*. These were *Mechanical*: but *Geminus Rhodius* the Master of *Proclus Lycius*, applied *Logick* to *Geometry*, out of particular *Elements* abstracting *Universals*. He demonstrated, That there are only *Three similar Species* of all *Lines*, viz. *Right*, *Circular*, and *Cylindrical*: And *Perseus* following his steps, enrich'd *Geometry* with the Invention of *three kinds* of *Crooked Lines*, the *Parabole*, *Hyperbole*, and *Elipsis*; for which he express'd his extatick joy, as *Thales*, *Pythagoras*, and *Archimedes* did upon like occasions, in a *Sacrifice* to the *Gods*. But to be briefer, *Pappus* improved the *Sphæricks*; *Theon* more *methodically* digested the *Elements* of *Euclide*; *Serenus Antinsensis* discover'd, that the *Section* of a *right Cylindre*, is the same with the *Elipsis* of a *right Cone*; *Copernicus* improved the *Doctrine* of *Triangles*; *Ramus* corrected and supplied *Euclide*, where his *Principles* were defective; *Maurolicus* writ first of *Secant Lines*; *Clavius* much illustrated and promoted the *Doctrine* of *Tangents*, *Secants*, *Triangles*, *Right Lines*, and *Sphericks*, besides what he did in his *Comment* upon *Euclide*. I might mention with These, the worthy Performances of *Cusanus*, *Pitiscus*, *Snellius*,

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Snellius, Ambrosius Rhodius, Kepler, Franciscus à Schoten, and others, who contributed very eminently to the perfections and advancements of *Geometry*, and were late men.

But none have done in it like the excellent Persons whom I reserve for my last mention; The chief are *Vieta, Des Cartes*, and *Dr. Wallis*.

CHAP. IV.

Improvements in Geometry by Des Cartes, Vieta, and Dr. Wallis.

IN order to my giving an account of some of their Performances, I must premise, That no great things can be done in *Geometry*, without the *Analytical Method*; And though some Learned Men conceive the *Ancients* were acquainted with *this* way of resolving Problems, yet their skill in it went no higher than the *Quadratick Order* of *Equations*, which They demonstrated by *Circles* and *Right Lines*, which They call'd *Loca plana*: but they were able to do nothing in the *Cubical Equations*, or any of the

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the *Superiour Orders* ; though they endeavour'd to cover their *defects* in this *Art*, by recourse *ad Locos Solidos*, (viz. *Conick Sections*) and *Lineares*, as they called them, such as the *Helix*, *Conchoeides*, and those of like nature. But those *tortous* and *curved Lines* being described *Mechanically* by *Compound Motions*, the *Problems* resolv'd by them are performed *Organically* by the *hand* and *eye*, not *Geometrically*.

This was the State of the *Analytick Art*, as long as Learning flourish'd in *Greece* ; when *That* was subdued by the *Barbarians*, their Learning with their Country pass'd to the *Arabians*, and also to the *Persians*, as we have it from *Hottinger* and *Bullialdus* : But these *Successors* of the *Greeks* did not advance their Learning beyond the *imperfect Stature* in which it was delivered to them. In that condition it remained till *Cardan* and *Tartaglia*, who made some small addition towards the *perfection* of it ; For they gave some Rules for solving *Cubical Equations*, which were certain in some cases, but not in all. Their *Invention* some other *Mathematical* men endeavour'd to advance, laying down Rules for solving some *Cubick* and *Biquadratick Equations* ; but could never find an *universal* way, that might

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might reach all such: Yea indeed they *utterly* despaired, and held it *impossible*. At length appears *Vieta*, who by inventing the *Method of Extracting Roots* in the most *numerous Equations*, and by converting the *Signs* used by the *Ancients* into *Letters*, brought *Algebra* to a very great *perfection*, as I have noted above; and by enriching the *Analytical Art*, by the *Accessions* of his *Exegetice Numerosa*, and *Logistice Speciosa*, he hath contributed infinite helps to *Geometry*. After him, divers other Learned men polish and adorned his Discourses; among whom I mention chiefly our Countrymen *Harriot* and *Oughtred*, who altered *Vieta's Notes* to advantage, and invented *Canons* to direct our *Operations* in the *Extracting of Roots*, both in *pure* and *adfected Equations*.

But after these had thus improved the *Analytick Art*, and well assisted *Geometry* by it, *Des Cartes* appears, one of the greatest *wits* that ever the Sun saw, a Person too *great* for praise, designed by *Heaven* for the *Instruction* of the Learned World, and who no doubt will be the Object of its *admiration*, as long as there is any *Learning* in it. This wonderful man

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in a few Pages, opens a way to mighty Performances: He shews us how all the Problems of Geometry may be brought to such terms, that we shall need nothing to the Construction and Demonstration of them, but the knowledge of the length of certain right Lines; and that, as all the Operations of Arithmetick are performed by Addition, Subtraction, Multiplication, Division, and Extraction of Roots (which is a species of Division) So in Geometry, for the preparation of Lines that they may be known, nothing needs more to be done, than that others be added to them, or subtracted from them; or if the Line be single (which that it may be the better referred to Numbers, may be called Unity) and beside that, two other Lines, that a Fourth be found which shall have the same proportion to one of these Lines, that the other hath to Unity, which is the same with Multiplication; or else, that by them a Fourth be found, which may have the same proportion to one of them, which Unity hath to the other, which is the same with Division; or lastly, That there be found between Unity, and some other Right Line, two or more mean Proportionals, which is the same thing with the Extraction of Quadratick and Cubick

Roots.

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Roots. And that he may justify the introducing of *Terms Arithmetical* into *Geometry*, he observes, That the avoiding thereof was an occasion of much *perplexity* and *obscurity* in the *Geometry* of the *Ancients*; of which he could give no other conjecture, but because they did not sufficiently understand the *affinity* and *cognition* of those Sciences. But if I should intend an *exact History* of all his Performances, I must *transcribe Him*; for he hath said so much in little, that 'tis impossible to abridge those his *close Composures*. I shall therefore only hint some principal things, referring you to his Writings for the rest.

And I take notice *first*, That he hath proposed an *Universal Method* for the *Solution* of all *Problems*; not only those propounded in *Right Lines*, *Plains*, and *Solids*: but also all that are made in *Angles*, a thing of most general Service in all parts of *Mathematicks*. By It he resolves the *famous Proposition* in *Pappus*, which was too hard for *Euclide*, *Apollonius*, and all the *Ancients*. He discourses the nature of *crooked Lines*, and shews which are fit to be used in *Geometrical Demonstrations*; Gives *Rules* for the place where to apply our selves in the *Demonstration* of any *Problem*;

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blem; and tells us, that a *Problem* after it is brought to an *Equation*, and reduced to its *least* terms, and the *unknown Quantity* is *Quadratick*, or of two dimensions, that then it may be demonstrated by a *Right Line* and *Circles*: but if the *Equation*, after it is reduced to its *least Terms*, leave the unknown *Quantity*, *Cubick* or *Biquadratick*, it must be demonstrated by some one of the *Conick Sections*. Whereas again, if after the *Equation* reduced, the unknown *Quantity* remain of five or six *Dimensions*, or more, *in infinitum*, then the *Demonstration* must be performed by *Lines* more and more *compound*, according to the *degree* of *Composition* in the *unknown Quantity* of the *Equation*. But because the way by *Lines* is *perplexed* and *tedious*, he gives *Rules* to reduce *Equations* of *many Dimensions*, to *fewer*. He shews how to *fill up defects*, when any *Terms* are wanting in the *Equation*; how to convert the *false Roots* into *true*, to avoid *Fractions*, and to *lessen Equations*. He hath demonstrated by a *Circle* and *Parabole* the famous *Problems* so much agitated among the *Ancients*, viz. the *Trisection* of an *Angle*, and the *finding two mean Proportionals between two Lines given*, with more brevity and expedition

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dition than any that went before him. And this, Sir, shall suffice by way of intimation, concerning that Prince of Mathematicians and Philosophers.

Since *him*, others have improved his *Method*. *Schotenius* hath demonstrated the *Loca Plana* of *Apollonius*: *Hadderus* hath added Inventions of use and pleasant speculation in his *Tract* of Reduction of *Æquations*. *Florimundus de Beaune* hath writ ingenious and profitable things *de Natura & Limitibus Æquationum*. But 'twould be endless to attempt full Accounts of the Modern Advancements of this Science, or indeed those accessions of growth it hath had since *Vieta*. And whoever should go about it, must reckon to begin anew as soon as he hath finish'd what he intended, since *Geometry* is improving daily.

I shall therefore add no more here, but only do right to an excellent Person of our own Nation, *Dr. John Wallis*, a Member of the *ROYAL SOCIETY*, to whom *Geometry* is exceedingly indebted for his rare Discoveries in that Science, Particularly, he hath propounded a Method for the measuring of all kind of crooked Lines, which is highly ingenious; and put an end

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to all future Attempts about *Squaring* the *Circle*, which hath puzzled and befooled so many *Mathematicians*, that have spent their *thoughts* and *time* about it. This he hath brought to effect as neer as it can be done, and shew'd the *exact* performance by *rational Numbers* impossible; He hath proposed excellent ways for the *measuring* all kinds of *Plains*, and all *multangular* and *solid Bodies*. But 'tis time now to proceed to the consideration of the next *Mathematical Science*, viz.

CHAP. V.

The late Improvements of Astronomy.

(4.) **A**STRONOMY, one of the grandest and most *magnifique* of all those that lie within the compass of *Natural Inquiry*. I shall not look back to its beginning among the *Chaldeans*, *Aegyptians*, and *eldest Grecians*, in which Times it was but *rude* and *imperfect*, in comparison to its *modern Advancements*. For the great Men among the *Greeks* are taken much notice of,
but

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but for very ordinary and trite things in this Science: As *Anaximander Milesius*, for teaching, That the Earth was Globous, and the Centre of the World not bigger than the Sun: *Anaximines* for affirming, That the Moon shone but with a borrowed Light; That the Sun and It were Eclips'd by the Earths interposal; and, That the Stars move round our Globe. And *Pythagoras* was the first that noted the obliquity of the *Ecliptick*. This Philosopher indeed was a Person of a vast reach, and said things in *Astronomy* very agreeable to late Discoveries: But the **Disputers** *Omniscient Aristotle* made very odd Schemes, not at all corresponding with the *Phænomena* of the Heavens, as appears from his *Hypotheses* of **Solid Orbs, Epicycles, Eccentrics, Intelligences**, and such other ill-contrived Phancies. Besides which, if I should descend to consider his now palpable Mistakes about the nature of *Comets*, the *Galaxy*, the *Sphere of Fire* under the *Moon*, and numerous other such, I should oblige my self to a large ramble. Wherefore to be as close as may be in these Notes, I observe, That after *Aristotle*, *Astronomy* was cultivated and improved by *Theophrastus*, *Aratus*, *Aristarchus Samius*, *Archimedes*, *Geminus*, *Menelaus*,

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nelaus, Theon, Hipparchus, Claudius Ptolemaeus, and infinite others among the Greeks,

Among *later* Authors, considerable things have been done in this way by both *Latins* and *Arabians*: To omit the latter, I shall give you some *particular Instances* of the other.

Johannes de Sacro Bosco ingeniously and methodically explained the *Doctrine* of the *Sphere*. *Thebit* first found the *Motion* of *Trepidation*. *Regiomontanus* published the first *Ephemerides*, and did excellent things in his *Theoricks* of the *Planets*. *Wernerus* stated the greatest *Declination* of the *Sun*. *Albertus Pighius* directed the way to find *Æquinoxes* and *Solstices*. *Baersius* framed *perpetual Tables* of the *Longitudes* and *Latitudes* of the *Planets*. *Copernicus* restored the *Hypothesis* of *Pythagoras* and *Philolaus*, and gave far more *neat* and *consistent Accounts* of the *Phænomena*. *Joachimus* made *Ephemerides* according to the *Copernican Doctrine*. *Clavius* invented a most useful *demonstrative Astrolabe*, and writ an *exquisite Comment* upon *Sacro Bosco*.

But I conclude the last Century with the Noble *Ticho Brahe*, who performed the glorious Work of restoring the *Fix'd Stars* to their *true places*, the *assignation* of which before

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before him, was rather by *guess*, than any *competent Rules*; and the *mistakes* here, were the very root and foundation of most *Errors in Astronomy*. For which reason it was, that *Copernicus* left that *earnest advice* to his Scholar *Joachim*, that he should apply himself to the *restitution* of the *Fix'd Stars*; for till this were done, there could be no hopes of attaining to the *true places* of the *Planets*, nor doing any thing to purpose in the whole *Science*. This engaged the Noble *Tycho* to this Enterprize, and he made it the Foundation of all the rest. The Method he used is described by *Gassendus*. By the help of this noble Performance he reformed the elder *Astronomical Tables*, both the *Ptolomaick* and *Copernican*. And from his Observations of the new Star of 1572, and six others in his time, he asserted *Comets* into their place among *Heavenly Bodies*, shattering all the *Solid Orbs* to pieces; And he hath done it with such *clear conviction*, that even the *Jesuits*, whose thralldom to the *Church of Rome*, deters them from closing with the *Motion* of *Earth*, confess a necessity of repairing to some other *Hypothesis* than that of *Ptolomy* and *Aristotle*. I might add to this, That this *generous Nobleman* invent-
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ed and framed such excellent *Astronomical Instruments*, as were by vast odds for use and convenience far beyond any of former times: Himself hath a Treatise concerning them. He hath also made exquisite *Tables* of the difference that *Refractions* make in the appearance of the *Stars*, and done more great things for *Astronomical Improvement*, than many *Ages* that were before him; for which reason I could not pardon my self in a curt mention of so glorious an Advancer of this Science.

The next Age after him, which is *ours*, hath made excellent use of his *Discoveries*, and those of his *Elder*, the famed *Copernicus*; and raised *Astronomy* to the noblest height and perfection that ever yet it had among men. It would take up a Volume to describe, as one ought, all the particular *Discoveries*: But my Design will permit but a short mention. Therefore briefly, I begin with *Galileo*, the reputed Author of the famous *Telescope*; but indeed the glory of the first Invention of that excellent Tube, belongs to *Jacobus Metius* of *Amsterdam*: but 'twas improved by the noble *Galileo*, and he first applied it to the *Stars*; by which incomparable Advantage, he discovered the Nature of the *Galaxy*, the 21 New Stars

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stars that compose the *Nebulosa* in the head of *Orion*, the 36 that conspire to that other in *Cancer*, the *Ansula Saturni*, the *Assella* of *Jupiter*, of whose *Motions* he composed an *Ephemeris*. By these *Lunula* 'tis thought that *Jupiters* distance from the *Earth* may be determined, as also the distance of *Meridians*, which would be a thing of vast use, since this hath always been measured by *Lunar Eclipses*, that happen but once or twice a year; whereas opportunities of *Calculating* by the *occultations* of these new *Planets* will be frequent, they recurring about 480 times in the year. Besides, to hasten off, *Galileo* discovered the strange *Phases* of *Saturne*, on while oblong, and then round; the increment and decrement of *Venus*, like the *Moon*; the *Spots* in the *Sun*, and its *Revolution* upon its own *Axis*; the *Moons* libration, collected from the various position of its *Macule*; and divers other wonderful and useful *Rarities*, that were strangers to all *Antiquity*. Shortly after *Galileo*, appears *Christopherus Scheiner*, who by greater *Telescopes* viewed the *Sun* with a curled and unequal *Superficies*, and in or near the *Horizon* of an *Elliptical* figure. He found also, That that supposed uniform *Globe* of *Light*, was of a different

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complexion in its several parts; some brighter than the main Body, as the *Facula*; others darker, as the *Macula*. He made more than 2000 *Observations* of them, and described their *Number*, *Magnitude*, *Situation*, *Figure*, and *Revolutions*. But I must contract. *Kepler* is next, who first proposed the *Elliptical Hypothesis*, made very accurate and luciferous *Observations* about the *Motions* of *Mars*, and writ an *Epitome* of the *Copernican Astronomy*, in the clearest and most perspicuous Method, containing the Discoveries of others, and divers considerable ones of his own; not to mention his *Ephemerides*, and Book about *Comets*. *Ant. Maria Shirleus*, with a new *Telescope* of a larger diameter than ordinary, discovered five other *Stars* more remote from *Jupiter* than his *Satellites*, and a kind of vapid *Atmosphere* about that *Planet*. *Franciscus Fontana* observed the same *Star*, with nine others never leaving it more than ten of its diameters; and in 1636. and 1643. with 8. Anno 1645. with 5, 1646. with 7. on other days with 6. varying their distances one to another, and not to be seen about *Mars* nor *Saturn*, nor without extending the *Telescope* more than was fitting for *Fix'd Stars*. These *Satellites* are observed to suffer

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fer a defection of their Light, when *Jupiter* interposeth between *them* and the *Sun*; whence it is inferr'd, That they have their Light from *It*, and that *Jupiter* hath none of his own to impart to them. But to pass on lightly, *Longomontanus* described the World according to all the *Hypotheses* of *Ptolomy*, *Copernicus*, and *Ticho Brahe*. *Fansonius Blaeu* made far more perfect and exact *Celestial Globes* than any were extant before. *Gassendus* writ judiciously of the *Stars* about *Jupiter*, and of *Mercury* in the *Sun*, and gave the World most excellent *Astronomical Institutions*. *Ismael Bullialdus* enrich'd the Science with a new Method to find and easily compute the *Paralaxes* of *Solar Ellipses*. *Hevelius* drew a *Graphical Description* of the *Moon* in all its *Phases*, as it appear'd in the *Telescope*, accurately delineating its *Spots*, and shewing the *inequality* and *mountanous protuberances* of its surface, which lends light to a vast *Theory*. Both these last named are Fellows of the *ROYAL SOCIETY*. Of the *Selenography* of *Hevelius*, *Ricciolus* made an *Improvement*, both as to the *Number*, *Figure*, *Magnitude*, *Site*, *Colour* of the *Macula*, and the *Eminencies*, *Profundities*, and *Asperities* of the *Lunar Superficies*. *Martinus Hortensius* found

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found *Mercury* to have variety of *Phases*, like the *Moon*; as, now *Horned*, then *Gibbous*, and at other times *Round*. But I conclude this Account with the most *Worthy* and *Learned* Prelate *Dr. Seth Ward*, now Lord Bishop of *Sarum*, who among his other excellent Performances in *Astronomy*, hath *demonstratively* proved the *Elliptical Hypothesis*, which is the most *plain* and *simple*, and performed by fewer Operations than either of the other. This indeed was *first* discours'd of by *Kepler*, advanced by *Bullialdus*, but *demonstrated* by this *accomplish'd* and *Venerable* Bishop, an *Honourable* Member of the *ROYAL SOCIETY*.

CHAP. VI.

Improvements of Opticks and Geography.

I Come next (5.) To consider the *OPTICKS*, whose *Improvements* are of great importance in the matters of *general Philosophy* and *humane Life*; since the
informations

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informations of Sense are the ground of both, and this Science rectifies and helps the noblest of them. Concerning it, there was once a Book of *Aristotle's* extant, according to *Laertius*: but it hath submitted to Time. Since him, this Science hath been cultivated by *Euclide*, and the celebrated *Archimedes*, who is said to have done strange things by it, upon the Ships of *Marcellus*: As *Proclus*, who improved the *Archimedean Artifices*, destroyed a Fleet by his *Specula Ustoria*, that besieged *Constantinople*. *Ptolemy* of *Alexandria* made considerable Improvements of *Opticks*; and *Alhazenus* the *Arabian*, is famous for what he did in It. From these, *Vitellio* drew his, and advanced the Science by his own Wit, and their Helps. *Stevinus* corrected *Euclide*, *Achazen*, and *Vitellio*, in some fundamental Propositions that were mistakes; and in their room substituted considerable Inventions of his own. *Roger Bacon* our fam'd Countryman, whom *Picus Mirandula* calls the *Phoenix* of his Age, and *Vossius*, one Learned to a miracle, writ acutely of *Opticks*. He was accused of *Magick* to *Pope Clement iv.* and thereupon imprisoned: But the Accusation was founded on nothing but his skill in *Mathematicks*, and the

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the ignorance of his *Accusers*. After these, the *Dioptricks* were improved by *Kepler*, *Gassendus*, *Mersennus*, and the noble and incomparable *Des Cartes*, who hath said the most *clear, useful, and improvable* things about it, that ever were extant on the Subject. But nothing hath so much advanc'd the Science, as the invention of the *Telescope* by *Metius*; and that other of the *Microscope*, concerning which I have to say in the following Instances. I pass therefore to the *last* I shall mention in the *Mathematicks*, which is,

(VI.) *GEOGRAPHY*. In this the *Ancients* were exceedingly defective. And *Aristotle* knew the world, by the same figure his *Scholar* conquer'd it. 'Tis noted by the ingenious *Varenius*, that the most *general* and *necessary* things in this Science were then *unknown*; as, The *Habitableness* of the *torrid Zone*; The *flux* and *reflux* of the *Sea*; The *diversity* of *Winds*; The *Polar* *propertie* of the *Magnet*; The *true dimension* of the *Earth*. They wanted *Descriptions* of remote *Countries*, concerning which both the *Greeks* and *Romans* had very *fabulous Relations*. They knew not that the *Earth* was encompassed by the *Sea*, and
might

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might be Sailed round. They were totally ignorant of *America*, and both the *North* and *South* parts of this *Hemisphere*; yea, and understood very little of the *remoter* places of their own *Asia*. *Fapan*, the *Java's*, the *Philippicks*, and *Borneo*, were either not at all *known*, or exceeding *imperfectly* of *old*: But all *these* are *familiar* to the *latter Times*. *Mexico* and *Peru*, and the *vast Regions* of those *mighty Empires*, with the many *Isles* of the *Great Sea* are disclosed. The *frozen North*, the *torrid Line*, and formerly *unknown South*, are *visited*, and by their numerous *Inhabitants* found not to be so *inhospitable* and *unkind* to men, as *Antiquity* believed. The *Earth* hath been *rounded* by *Magellan*, *Drake*, and *Candish*. The *great Motion* of the *Sea* is *vulgar*, and its *varieties* inquiring every day: The *diversities* of *winds* *stated*, and better understood: The *Treasure* of *hidden Vertues* in the *Loadstone*, found and used. The *Spicy Islands* of the *East*, as also *those* of the *remote South* and *North*, *frequented*, and the *knowledge* of that *People* and those *Countries* transmitted to us, with their *Riches*; The most distant being *Parts Travell'd* and *Describ'd*. Our *Navigation* is far greater, our *Commerce* is more general,

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our *Charts* more exact, our *Globes* more accurate, our *Travels* more remote, our *Reports* more intelligent and sincere; and consequently, our *Geography* far more perfect, than it was in the *elder Times* of *Polybius* and *Possidonius*, yea than in those of *Ptolomy*, *Strabo*, and *Pomponius Mela*, who lived among the *Cæsars*. And if It was so short in the *flourishing Times* of the *Roman Empire*, how was it before, in the days of *Aristotle* and the *Gracians*? We have an Instance of it in the *Great Macedonian*, who thought the *bounds* of his *Conquests* to be the *end* of the *world*; when there were *Nations* enough beyond them, to have eaten up the *Conqueror*, with his *proud* and *triumphant Armies*. So that here also *Modern Improvements* have been great; and you will think so, if you compare the *Geographical Performances* of *Gemma Frisius*, *Mercator*, *Ortelius*, *Stevinus*, *Bertius*, and *Guil. Blaeu*, with the best Remains of the most celebrated *Geographers* of the more *ancient Ages*.

CHAP. VII.

*That Useful Knowledge is to be aided
by Instruments. Modern Instances
of such. Of the Telescope, Mi-
croscope, and Thermometer.*

THus, Sir, I have touched upon some
of the *Improvements* of the *ARTS*
that search into the *recesses* and *intrigues* of
Nature, with which *latter Ages* have assist-
ed *Philosophical* Inquiries. And in *these* I see
I have struck farther than I was aware, in-
to the account of those things also which
lead us to the *grosser Phenomena*; and my
Remarques about *Geography* are all of that
nature. However I shall not alter my Me-
thod; but after I have discours'd the *IN-*
STRUMENTS I mentioned for Use-
ful Knowledge, I shall consider somewhat
of *NATURAL HISTORY*, which
reports the *Appearances*, and is *fundamen-*
tally necessary to all the Designs of *Science*.
As for the *INSTRUMENTS* then,
that are next, before I come to give you

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the Notes I intend concerning them, I observe, That

The *Philosophy* that must signifie either for *Light* or *Use*, must not be the *work* of the *Mind* turned in upon *it self*, and only conversing with its own *Ideas*; but *It* must be raised from the *Observations* and *Applications* of *Sense*, and take its Accounts from Things as they are in the *sensible world*. The Illustrious Lord *Bacon* hath noted this as the chief cause of the unprofitableness of the *former Methods* of *Knowledge*, viz. That *they* were but the *Exercises* of the *Mind*, making *Conclusions*, and spinning out Notions from its own *native store*; from which way of proceeding, nothing but *Dispute* and *Air* could be expected. 'Twas the fault that Great Man found in the Ancients, That they flew presently to *general Propositions*, without staying for a *due information* from Particulars, and so gradually advancing to *Axioms*: Whereas the *Knowledge* from which any thing is to be hoped, must be laid in *Sense*, and raised not only from some few of its *ordinary Informations*; but *Instances* must be aggregated, compared, and critically inspected, and examined singly and in consort. In order to which Performances, our *Senses* must

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must be aided; for of themselves they are too narrow for the *vastness* of things, and too *short* for *deep Researches*: They make us very *defective* and *unaccurate Reports*, and many times very *deceitful* and *fallacious ones*. I say therefore, *they* must be assisted with *Instruments* that may *strengthen* and *rectifie* their Operations. And in *these* we have mighty *advantages* over *Aristotle* and the *Ancients*; so that much greater things may well be expected from *our Philosophy*, than could ever have been performed by *theirs*, though we should grant them all the *superiority* of *wit* and *Understanding* their fondest Admirers would ascribe to those *Sages*. For a *weak hand* can move more *weight* by the help of *Springs, wheels, Leavers*, and other *Mechanick Powers*, than the *strongest* could do without them. And that we really have these *Advantages*, must be shewn by *Instance*: I mentioned *Five* that are considerable to that purpose, which I took notice of among many others; and they were the *TELESCOPE*, *MICROSCOPE*, *THERMOMETER*, *BAROMETER*, and *AIR-PUMP*.

(I.) The *TELESCOPE* is the most excellent *Invention* that ever was, for assisting the *Eye* in *remote Discoveries*. The di-

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stance of the Heavens is so vast, that our *unaided Senses* can give us but extremely imperfect Informations of that Upper World; And the *speculations* that *Antiquity* hath raised upon them, have for the most part been very mean, and very false: But these excellent *Glasses* bring the *Stars* nearer to us, and acquaint us better with the immense Territories of *Light*: They give us more *Phænomena*, and truer *Accounts*; disperse the shadows and vain Images of the twilight of naked sense, and make us a clearer and larger prospect. By these Advantages they enlarge our *Thoughts*, and shew us a more magnificent Representation of the *Universe*: So that by them the *Heavens* are made more amply to declare the *Glory* of God, and we are help'd to nobler and better-grounded *Theories*. I have mentioned in my Account of the Advance of *Astronomy*, some of the most remarkable Discoveries that have been made by these *Tubes*, which exceedingly transcend all the *Imaginations* of *Elder Times*; and by the further improvement of them, other things may be disclosed as much beyond all ours. And the present *Philosophers* are so far from desiring that *Posterity* should sit down contented with their Discoveries and Hypotheses,

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ses, that they are continually solicitous for the gaining more *helps* to themselves, and *those* that shall follow, for a further progress into the knowledge of the *Phænomena*, and more *certain judgments* upon them. So that these *Glasses* are exceedingly *bettered* since their *Invention* by *Metius*, and *application* to the *Heavens* by *Galileo*; and several ingenious Members of the *ROYAL SOCIETY* are now busie about improving them to a greater height. What success and informations we may expect from the *Advancements* of this *Instrument*, it would perhaps appear *Romantick* and *ridiculous* to say; As, no doubt, to have talk'd of the *spots* in the *Sun*, and *vast inequalities* in the *surface* of the *Moon*, and those other *Telescopical certainties*, before the *Invention* of that *Glass*, would have been thought *phantastick* and *absurd*. I dare not therefore mention our *greatest hopes*: but this I adventure, That 'tis not unlikely but *Posterity* may by those *Tubes*, when they are brought to *higher degrees* of *perfection*, find a *sure way* to determine those *mighty Questions*, *whether the Earth move?* or, *the Planets are inhabited?* And who knoweth which way the *Conclusions* may fall? And 'tis probable enough,

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that another thing will at last be found out, in which this lower World is more immediately concerned, by *Telescopic Observations*, which is, the most desired *Invention of Longitudes*; upon which must needs ensue yet greater Improvements of *Navigation*, and perhaps the Discovery of the *North-west Passage*, and the yet *unknown South*. Whatever may be thought of these Expectations by Vulgar and *narrow Minds*, whose *Theories* and *Hopes* are confin'd by their *Senses*, those that consider, that *one Experiment* discovered to us the vast *America*, will not *despair*. But 'tis time to pass from *this*, to a *second Modern Aid*, whereby our *Sight* is assisted, which is,

(II.) The *MICROSCOPE*. The *Secrets* of Nature are not in the greater *Masses*, but in those *little Threds* and *Springs* which are too *subtile* for the *grossness* of our *unhelp'd Senses*; and by *this Instrument* our eyes are assisted to look into the *minutes* and *subtilties* of things, to discern the otherwise *invisible Schematisms* and *Structures* of *Bodies*, and have an advantage for the finding out of *Original Motions*; To perceive the *exactness* and *curiosity* of Nature in all its *Composures*; And from *thence* take *sensible Evidence* of the
Art

of Useful Knowledge. 57

Art and wisdom that is in its Contrivance ; To disclose the *variety* of *living Creatures* that are shut up from our *bare Senses*, and open a kind of other World unto us, which its *littleness* kept unknown. *This Instrument* hath been exceedingly improved of late, even to the *magnifying* of Objects a thousand times, and many useful *Theories* have been found and explicated by the *notices* it hath afforded ; as appears by the *Microscopical Writings* of those ingenious *Mechanicks*, Members of the *ROYAL SOCIETY*, Dr. *Power* and Mr. *Hooke*.

But (III.) The *THERMOMETER* was another *Instrument* I mentioned, which discovers all the small *unperceivable variations* in the *heat* or *coldness* of the *Air*, and exhibits many rare and *luciferous Phenomena*, which may help to better Informations about those *Qualities*, than yet we have any. And as to this, I observe with the great *Verulam*, and the other *Bacon* the Illustrious Mr. *Boyle*, That *Heat* and *Cold* are the *right* and *left* hand of *Nature*. The *former* is the great *Instrument* of most of her Operations ; and the *other* hath its *Interest*. And yet the *Philosophy* of *Aristotle* hath neither *done* nor as much as *attempted* any thing toward the *Discovery* of their Natures ;

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Natures ; but contented it self with the *jeune, vulgar, and general* description, *That Heat is a Quality that gathereth together things of a like nature, and severs those that are unlike ; and Cold congregates both.* But now if we will know any thing deeply in the business of *Rarefaction and Condensation*, the Doctrine of *Meteors*, and other material Affairs of Nature , other Accounts about these things must be endeavoured ; and the bare *informations* of our *Senses*, are not *exact* enough for this purpose ; for their *Reports* in this kind are *various and uncertain*, according to the *temper and disposition* of our *Bodies*, and several *unobserved accidental mutations* that happen in them. This *Instrument* therefore hath been invented to supply their *defects* ; and it gives far more *constant and accurate*, though perhaps not always *infallible Relations* : but the justest are afforded by the *Sealed Thermometer*. And besides the *Uses* of this *Instrument* I suggested, it will help very much in framing the *History of Weather*, which may be applied to many excellent purposes of *Philosophy*, and services of *Life*.

CHAP. VIII.

Of the Barometer and Air-Pump,
and what Advantages we have and
may further expect from these In-
struments.

BUT (IV.) The *BAROMETER* is
another late *Instrument* very helpful
to *Useful Knowledge*. That there is *gravity*
even in the *Air* it self, and that *that Element*
is only *comparatively light*, is now made
evident and palpable by *Experience*, though
Aristotle and his *Schools* held a different *The-
ory*: And by the help of *Quicksilver* in a
Tube, the way is found to measure all the
degrees of Compression in the *Atmosphere*, and
to estimate exactly any *accession of weight*,
which the *Air* receives from *winds*, *Clouds*,
or *Vapours*. To have said in *Elder Times*,
That *Mankind* should light upon an *Inven-
tion* whereby those *Bodies* might be
weigh'd, would certainly have appeared
very *wild and extravagant*; and it will be
so accounted for some time yet, till men
have

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have been longer and are better acquainted with *this Instrument* : For we have no reason to believe it should have *better luck* than the *Doctrine of the Circulation*, the *Theory of Antipodes*, and all *great Discoveries* in their *first Proposals*. 'Tis impossible to persuade some of the *Indians* that live near the *heats of the Line*, that there is any such thing as *Ice* in the *World* ; but if you talk to them of *Water* made *hard and consistent* by *Cold*, they'l laugh at you as a *notorious Romancer*. And those will appear as *ridiculous* among the most of us, who shall affirm it *possible* to determine any thing of the *weight of the Wind or Clouds*. But *Experience* turns the *laugh* upon the *confident incredulity* of the *Scoffer* ; and he that will not *believe*, needs no more for his *conviction*, than the labour of a *Tryal*. Let him then fill a *Tube of Glass* of some Feet in length, with *Quicksilver* ; and having *sealed* one end, let him stop the other with his Finger, and *immerge* that which is so *stop'd* into a *Vessel of Mercury*, the *Tube* being *perpendicularly erected* ; let him then *substract* his Finger, and he will perceive the *Quicksilver* to descend from the *Tube* into the *subjacent Vessel*, till it comes to 29 *Digits* or thereabouts ; there, after some *Vibrations*,

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brations, it ordinarily rests. The reason that this remainder of the *Mercury* doth not descend also, is, because such a *Mercurial Cylinder* is just *equiponderant* to one of the *incumbent Atmosphere* that leans upon the *Quicksilver* in the *Vessel*, and so hinders a further descent. It is concluded therefore, That such a *Cylinder* of the *Air* as presses upon the *Mercury* in the *Vessel*, is of equal weight to about 29 *Digits* of that ponderous Body in the *Tube*. Thus it is when the *Air* is in its ordinary temper: but *Vapours*, *Winds*, and *Clouds* alter the *Standard*, so that the *Quicksilver* sometimes falls, sometimes rises in the *Glass*, proportionably to the greater or less accession of gravity and compression the *Air* hath received from any of those alterations; and the Degree of increase beyond the *Standard*, is the measure of the additional gravity. This Experiment was the *Invention* of *Torricellius*, and used to little more purpose at first, but to prove a *Vacuum* in Nature; and the deserted part of the *Glass-Tube* was by many thought an absolute void, which I believe is a mistake: But it hath been since improved to this Design of weighing the degrees of compression in the *Air*; a thing that may signify much, in giving us to understand its temper in several

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veral Places, on *Hills* and in *Caves*, in divers *Regions* and *Climates*, which may tend to the disclosing many excellent *Theories* and *helps* in *humane Life*. And the *Air* is so *Catholick* a Body, and hath so great an *influence* upon all *others*, and upon *ours*, that the advantage of such an *Instrument*, for the better acquainting us with its *nature*, must needs be very considerable, and a good *Aid* to *general Philosophy*. And who yet knows how *far*, and to what *Discoveries* this *Invention* may be improved? The World a long time only *rudely star'd* upon the *wonders* of the *Loadstone*, before its *use* was found for the *advantage* of *Navigation*; and 'tis not impossible, but that *future Times* may derive so much *benefit* one way or other from *this Invention*, as may equal its *esteem* to *that* of the *Compass*. The ROYAL SOCIETY, by their *Care* and *Endeavours* in the using this *Instrument*, give us hopes, that they will let none of its *useful Applications* to escape us. And I know not whether we may not mention it as the first great benefit we have from it, that it was an occasion of the *Invention* of Mr. Boyle's famous *Pneumatick Engine*: And this is the other *Instrument* I noted, and call'd

(V.) The

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(V.) The *AIR-PUMP*, concerning the *usefulness* of which, that excellent Person himself hath given the best Accounts, in his Discourse of *Physico-Mechanical Experiments* made in that *Engine*, by which he hath discovered and proved a rare and *luciferous Theory*, viz. the *Elastick Power* or *Spring* of the *Air*, and by *this*, hath put to flight that *odd Phancy* of the *Fuga vacui*, and shewn, that the *strange Effects* which use to be ascribed to that *general* and *obscure cause*, do arise from the *native self-expansion* of the *Air*. The extent of which *Elastical Expansion*, he hath found divers ways to measure by his *Engine*, which also discovers the *influence* the *Air* hath on *Flame*, *Smoke*, and *Fire*; That it hath *none* in *Operations Magnetical*; That it is probably much *interspersed* in the *Pores* of *Water*, and *comprest* by the *incumbent Atmosphere*, even in those *close retreats*; What operation the *exsuction* of the *Air* hath on other *Liquors*, as *Oyl*, *Wine*, *Spirit of Vinegar*, *Milk*, *Eggs*, *Spirit of Urine*, *Solution of Tartar*, and *Spirit of Wine*; The *gravity* and *expansion* of the *Air* under *water*; The interest the *Air* hath in the *vibrations* of *Pendulums*, and what it hath to do in the *propagation* of *Sounds*; That *Fumes* and
Vapours

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Vapours ascend by reason of the gravity of the *Ambient*, and not from their own positive levity ; The nature of *Suction*, the cause of *Filtration*, and the rising of *water* in *Siphons* ; The nature of *Respiration*, and the *Lungs* illustrated by tryals made on several kinds of *Animals*, and the interest the *Air* hath in the Operations of *Corrosive Liquors*. These, and many more such like *beneficial Observations* and Discoveries, hath that great man made by the help of his *Pneumatick Engine* ; and there is no doubt but more, and perhaps greater things will be disclosed by it, when *future ingenuity* and *diligence* hath improved and perfected this Invention. (For what great thing was *absolute* and *perfect* in its *first rise* and beginning ?) And 'tis like this *Instrument* hereafter will be used and applied to things yet unthought of, for the *advancement* of *Knowledge* and *conveniences* of *Life*.

CHAP. IX.

The Credit of Optick-Glasses vindicated, against a **Disputing Man**, who is afraid to believe his Eyes against Aristotle.

THus, Sir, I have performed the first part of my promise, by shewing what *Advantages* the *latter Ages*, and particularly the *ROYAL SOCIETY*, have for deep search into things both by *ARTS* and *INSTRUMENTS* newly invented or improved, above those enjoy'd by *Aristotle* and the *Ancients*.

To my Discourse about the *Dioptrick Tubes*, the *Telescope* and *Microscope*, the **Reverend Disputer** replied, [*That our Glasses were all deceitful and fallacious.*] Which Answer minds me of the good *Woman*, who when her Husband urged in an occasion of difference, [*I saw it, and shall I not believe my own Eyes?*] Replied briskly, **Will you believe your own Eyes, before your own Dear Wife?** And it

G

seems

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seems *this Gentleman* thinks it unreasonable we should believe *ours*, before his *own dear Aristotle*.

For an assurance of the *credit* of those *Glasses*, I told him he might *try* them upon *objects near*, and *easily visible* by the *unassisted sight*; and if he made the *tryal*, he would find they *altered* the *objects* in nothing but their *proportions*, which are represented *larger* for the advantage of *vision* in things *small* and *remote*; and we have all the like reasons to *distrust* our *Eyes*, as *these Glasses* (for their *informations* are the *same* in all things, but the *mentioned difference*) and there is no man so much a fool, as not to make allowances for *that*. Never was any yet so grossly deceived by the *Microscope*, as to be perswaded that a *Flea* is as *big* as a *Lobster*; nor did the *Telescope* ever make any one believe that the *Moon* was at the *end* of his *Tube*: But if the *former* represents that *little Creature* as *bristled* and *jamar'd*, and the *other* makes the *Planet* *mountanous* and *uneven*, we have no reason to believe but that their *reports* are *sincere*, though our *unaided Senses* are too *gross* to perceive either the one or other; since, if the mentioned *bristles* and *jamars* are in the *Glass*, and not in the *Animal*, they
would

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would appear in like manner in all the small Creatures which in the same light and position are look'd on through the *Microscope*: And if the *ruggedness* of surface were in it, and not in the *Moon*, the same would be seen upon all other *distant objects*, that are view'd through the other *Optick Instrument*. And if there be *deceit* in those *Glasses*, Seamen had need beware how they trust them, since the *Flags* which appear to be *those* of their *Friends* in the *Perspective*, may be really the *Colours* of their *Enemies*.

Upon these accounts, Sir, which afford plain and sensible evidence, I wondered much at the **Disputer's** strange suspicion, which had been scarce pardonable in a vulgar head; and I know not what to call it in one, that would be thought a *Philosopher*: But the wary man gave a reason, which made me as much wonder at his *Argument*, as his *Doubt*. And to this attend Ye *Philosophers* of the *ROYAL COLLEDGE*, and prepare your selves to answer a *Demonstration* from *Experience*, against your *Glasses*; Raise your *Expectations* for a wonderful, *convictive Experiment*; Let the *Mountains* travel, and the *Birth* will follow. [Take two *Spectacles* (saith the **Experimental Sage**)

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Sage) use them at the same time, and you will not see so well as with one singly.] Therefore your *Microscopes* and *Telescopes* are impostors. This man, Sir, is a *Logician*, and no doubt you perceive so. O how I admire this rare faculty of *arguing*! How dull are our wits, to those subtle, Eagle-eyed Schoolmen, who see *Conclusions* so far off, through the more unerring *Telescopes* of their own piercing Understandings? Did ever old man before make this use of his *Spectacles*? But to leave wondring, let's endeavour to understand this *Philosophy of Chue*. How a man may see by *Spectacles*, that *Perspectives* are deceitful. [We can see better through one pair, than two] saith the **Deep Philosopher**. Most sagely observ'd! The Argument begins strongly: But in the Name of *Aristotle*, whence comes the *Consequence*? Therefore *Perspectives* are fallacious.

One Proposition for Sence;
And th' other for Convenience:

This fits his purpose to discredit new Discoveries, 'tis no matter how it follows. This Gentleman, you must know Sir, useth to have his word taken among his admiring Neighbours,

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Neighbours, and so is not wont to be put to the trouble of proving: but I was so unmannerly as to expect it, chusing rather to see with mine own Eyes, than his infallible Spectacles. *We can see better*——saith the **Disputer**. How doth he know that? If *Perspectives* deceive us, though *naked sense* witness for them, Why may not his *single Spectacles* be as deceitful as they? These represent things bigger than they are to the *unaided sight*; and the *Philosophical Glasses* do but the same thing, in a higher degree of *magnifying the Object*. But we allow him the benefit of his *single Spectacles*, though he will not be so courteous to our *Glasses*, and confess his **Reverend Experiment** of the use of *two*, but are *inquisitive* about the *Consequence*. The Reason of which certainly *must be* (if any be intended in it) that our *Telescopes* and *Microscopes* have a *Glass* at each end, which the **Man of Sapience** thinks answers the two pair of *Spectacles*, and therefore must render the *Representation* deceitful. If this *Philosopher* had spared some of those thoughts to the profitable Doctrine of *Opticks*, which he hath spent upon *Genus* and *Species*, we had never heard of this *Objection*, which is as much a reason against the credit of all

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Perspective Glasses whatsoever, as the *Philosophical* ones he would discredit. And without more *Opticks* than those of *natural Understanding*, he might, if it had pleased him, have known, that we see better through the *two Glasses* in *Perspectives*, than any *single* one; because they are so fashioned and ordered, that the *visive rays* are better gathered and united by them for the advantage of sight: But in the *two Spectacles*, the case is contrary. These things I suggested, and some others from the *Dioptricks*, in which this **Sage** Person was pleased then to conceal his Knowledge; and how great *that* was in these matters, will appear by the *Learned Problem* he proposed at this period of our Discourse, *viz.* **[Why we cannot see with two pair of Spectacles, better than with one singly?]** For, saith the **Man of Arioms**, *Vis unita fortior?*] A pleasant piece of *Philosophy* this; and I'll shew the **Disputer** how strongly he infers from his *Maxim*, by another Question like it. Why cannot he write better with *two Pens*, than with a *single* one, since *Vis unita fortior?* When he hath answered *this Quere*, he hath resolved his own. I said in the Discourse, That the reason he gave why one would expect it

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it should be so, is the reason why 'tis not; and this is plain enough to *sense*, from the *confusion of Vision*, which shews, that the rays are *not united* after the way requisite for the aiding the sight (as I just now intimated) and how that should be, I had here shewn, but that I am ashamed to add more in *earnest* about a **grave** foolery. And I confess, Sir, I account these *personal* matters a kind of Digression from the main thing I intended. To return therefore to my Subject.

CHAP. X.

*Our Advantages for Knowledge,
from Modern Improvements of Na-
tural History.*

HAVING discours'd the modern Helps *Useful Knowledge* hath for deep Research, I am next

(2.) To recount what *Aids* it hath received from our *better* acquaintance with the *Phænomena*. For *this* I must consider *NATURAL HISTORY* more particularly,

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ticularly, which is the *Repository* wherein these are lodg'd. How *this* may be compiled in the best order, and to the best advantage, is most judiciously represented by the *Immortal* Lord Bacon; and to shew how highly It hath been *advanced* in *modern Times*, I need say little more, than to amass in a brief *Recollection*, some of the *Instances* of *newly-discovered Phenomena*, which are scatter'd under the Heads of the *Arts* and *Instruments* I have discours'd, with the *Addition* of some others: As,

In the *HEAVENS*, those of the *Spots* and *Dinettick motion* of the *Sun*, the *mountainous protuberances* and *shadows* in the body of the *Moon*, about *nineteen Magnitudes* more of *Fixed Stars*, the *Lunule* of *Jupiter*, their *mutual Eclipsing* one another, and its *turning round* upon its own *Axis*; the *Ring* about *Saturn*, and its *shadow* upon the *Body* of *that Star*; the *Phases* of *Venus*, the *increment and decrement* of *Light* among the *Planets*, the *appearing and disappearing* of *Fixed Stars*, the *Altitude* of *Comets*, and *nature* of the *Via Lactea*. By these *Discoveries*, and more such, the *History* of the *Heavens* hath been *rectified*, and *augmented* by the *Modern Advancers* of *Astronomy*, whom in their place I have cited.

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cited. In the *AIR*, *Its Spring*, the more accurate *History* and *Nature of Winds* and *Meteors*, and the probable height of the *Atmosphere*, have been added by the Lord Bacon, Des Cartes, Mr. Boyle, and others. In the *EARTH*, *New Lands* by Columbus, Magellan, and the rest of the Discoverers; and in these, *new Plants*, *new Fruits*, *new Animals*, *new Minerals*, and a kind of *other world of Nature*, from which *this* is supplied with numerous conveniences of *Life*, and many thousand Families of our own *little one* are continually fed and maintained. In the *WATERS*, the great *Motion* of the *Sea*, unknown in elder Times, and the particular *Laws of flux and reflux* in many places, are discover'd. The *History of BATHES* augmented by Savonarola, Baccius, and Blanchellus; of *METALS* by Agricola; and the whole *SUBTERRANEOUS WORLD* described by the universally Learned Kircher. The *History of PLANTS* much improved by Matthioli, Ruellius, Bauhinus, and Gerard, besides the late Account of *English Vegetables* publish'd by Dr. Merret, a worthy Member of the *ROYAL SOCIETY*. And another excellent *Virtuoso* of the same Assembly,

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Assembly, Mr. John Evelyn, hath very considerably advanced the *History of Fruit and Forest-Trees*, by his *Sylva* and *Pomona*; and greater things are expected from his *Preparations for Elysium Britannicum*, a noble Design now under his hands: And certainly the *inquisitive World* is much indebted to this *generous Gentleman* for his very *ingenious Performances* in this kind, as also for those others of *Sculpture, Picture, Architecture*, and the like *practical, useful things* with which he hath inrich'd it. The *History of ANIMALS* hath been much enlarged by *Gesner, Rondeletius, Aldrovandus*, and more accurately inquir'd into by the *Micrographers*: And the late Travellers, who have given us Accounts of those *remote parts of the Earth*, that have been less known to these, have described great *variety of Living Creatures*, very different from the *Animals* of the *nearer Regions*; among whom the *ingenious Author* of the *History of the Caribbies* deserves to be mentioned as an Instance. In our own *BODIES Natural History* hath found a rich heap of Materials in the above-mentioned Particulars of the *Vena Lactea*, the *Vasa Lymphatica*, the *Valves and Sinus* of the *Veins*, the several *new Passages* and *Glandules*,

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Glandules, the Ductus Chyliferus, the Origination of the Nerves, the Circulation of the Blood; and the rest. And all the main Heads of Natural History have receiv'd aids and increase from the famous Verulam, who led the way to substantial wisdom, and hath given most excellent Directions for the Method of such an HISTORY of NATURE.

CHAP. XI.

The Advantages of late Ages for spreading and communicating Knowledge. Three great Instances of it, in Printing, the Compass, and the Royal Society.

THUS, Sir, I have dispatch'd the *FIRST* Part of my Method propos'd in the *beginning*; but stand yet engag'd for the *other*, which is to shew,

(II.) That the *later* Ages since *Aristotle* have had great *advantages* of him, in respect of Opportunities and Helps for the *spreading and communicating Knowledge,*
and

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and thereby of *improving and enlarging it*. And methinks the very mention of *Ages* and *Aristotle*, by way of *comparison* in this case, hath so much of *absurdity* in it, that I am almost ashamed to proceed further in the proof of such a Proposition as this, viz. *That the Advantages of Mankind in the Succession of two thousand years, are more than those of a single Person who lived but sixty three*. Certainly those that have the fondness to think the contrary, have a Faith that exceeds all the *Extravagancies of Fiction*: For never any *Romance* was so *absurdly vain*, as to feign an *Heroe* whose *single strength and valour* exceeded *Armies* of other *Mortals*. And 'tis not less *absurd* to suppose the *wit* of one man, and he an *Idolater* and an *Heathen*, to transcend the *joynt Understandings* of all the *wiser World*, though *assisted by his Knowledge*, the *Light of Christianity*, and the *aggregated Informations and Endeavours* of many *Learned Ages*: But my **Reverend Opposite** had this belief, and hath thereby out-done the largest *excesses of Poetry*. For *his sake* therefore, and *those others* that are of *this* more than *hyperbolical Faith*, I add the *SECOND Part* of my proposed *Method*, though what I have said already upon

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upon the *First*, is, I judge, more than sufficient for that purpose; And yet I think it not impertinent to subjoyn those other *Considerations*, both because they will further discover the unreasonable vanity of the *doating* Spirits, that oppose all *generous Endeavours* for the *advance* and *improvement* of *Knowledge*; and (which may signifie more) will *excite* and *encourage* *Hopes* of *Modern Attempts*: and *Hope* is the *fuel* of *Activity* and *Endeavour*.

I descend to demonstrate then by *palpable* and *undeniable Instances*, That we have *Advantages* above *Aristotle*, and, which is much more, above all elder Times, for *mutual Communications*, and *impartments* of our *Notices*, *Observations*, *Experiments*, and *Performances* for the *increase* of *Science*. My *Instances* are *THREE*, *PRINTING*, the *COMPASS*, and the *ROYAL SOCIETY*.

For the *FIRST*, *PRINTING*, It was, according to *Polydore Vergil*, the *Invention* of *John Cuthenberg* of *Mentz* in *Germany*, though others give the honour to one *Fust* of the same City, and some to *Laurentius* a Burger of *Haerlem*. But whoever was the *Author*, this is agreed, That this excellent *Art* was *first practised* about
the

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the year 1440. and was utterly *unknown* in *elder Times*; at least in all the parts of the *World* that are on this side the Kingdom of *China*, which they say had it more *early*; but it signifies not to our purpose. Now by reason of the *Ancients* want of *this Invention*, *Copies* of excellent things could not be so much *dispersed*, nor so well *preserv'd* either from the *Corruptions* of *Time* or *Design*. The *Charge* of *Books* was very *great*, *forgeries* *frequent*, and *mistakes* of *Transcribers* *numerous*. They were quickly swept away out of those few *Libraries* in which they were, by *Fire* and *Violence*, or *spoiled* by *Dust* and *Rottenness*. And in the *absence* of this *Art*, 'twas easie enough for one *Aristotle* to *destroy* the most considerable *Remains* of the *Ancients*, that the power of his *great* Scholar put into his hands; which, 'tis credibly reported of him, that he did, to procure more *Fame* for his *own* Performances: as also to *conceal* his *thefts* and *injurious* dealings with those *venerable* Sages, whom he seems to take a great delight to *contradict* and *expose*, as I have elsewhere proved. But *now*, by this *excellent Invention*, the Knowledge that is lodged in *Books*, is put beyond the danger of such *Corruptions*, *Forgeries*, or any *fatal*

incon-

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inconvenience. We communicate upon *easy* terms at the *remotest* distance, converse with the *wisemen* that went before us, and *securely* convey down our Conceptions to the *Ages* that shall follow. So that by this means *Knowledge* is advantageously *spread* and *improved*; especially since the *Affluence* modern *Ingenuity* hath brought us, in that other *admirable* *Invention*,

(2.) The COMPASS. How *defective* the *Art* of *Navigation* was in *elder* Times, when they *Sailed* by the *observation* of the *Stars*, is *easy* to be *imagin'd*: For in dark weather, when their *Pleiades*, *Helice*, and *Cynosura* were hidden from them by the *intervening* *Clouds*, the *Mariner* was at a loss for his *Guide*, and exposed to the *casual* conduct of the *winds* and *Tides*. For which reason the *Ancients* seldom or never durst venture into the *Ocean*, but steer'd along within sight of the *safer* *Shore*. So that the *Commerce* and *Communications* of those Days were very *narrow*; Their *famed* *Travels* in comparison were but *domestick*; and a *whole* *World* was to them unknown. But it hath been the happy privilege of *later* Days to find the way to apply the *wonderful* *Vertues* of the *Loadstone* to *Navigation*; and by the direction of the
Compass

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Compass we securely commit our selves to the *immense Ocean*, and find our path in the *wastest wilderness of waters*. So that *Commerce* and *Traffique* is infinitely improved, the *other half* of the *Globe* disclosed, and that on this side the *great Sea* better understood. The *Religions*, *Laws*, *Customs*, and all the *Rarities* and *Varieties* of *Art* and *Nature*, which any the most distant *Clime* knows and enjoys, are laid open and made common; and thereby the *History* of *Nature* is wonderfully enlarged, and *Knowledge* is both propagated and improved.

Who it was that first discovered this excellent *Mystery*, is not certainly known: But one *Flavius Goia* of *Amalphis* in the Kingdom of *Naples*, is said to be the *Author*; and to have found this incomparable *Rarity* about 300 years ago. 'Tis pity that one of the greatest *Benefactors* to mankind that ever was, should lie hid in so neglected an *obscurity*; when the great *Troublers* of the *World*, who have vex'd it by the *Wars* of the *Hand* and of the *Brain*, have so dear and so precious a *Memory*. For my part I think there is more acknowledgment due to the name of this *obscure* Fellow, that hath scarce any left, than to a thousand *Alexanders* and *Cesars*, or to ten times the

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the number of *Aristotles*. And he really did more for the increase of Knowledge, and advantage of the World by this one Experiment, than the numerous *subtile Disputers* that have lived ever since the erection of the *School of talking*.

And methinks it may not be improper for me here to take notice of that other great *German Invention*, that useth to be mentioned in the Company, viz. That of *GUNPOWDER* and *ARTILLERY*, which hath done its Service also for the help and propagation of Knowledge, as you will perceive, when you shall consider, that by the assistance of these terrible *Engins of Death*, the great *Western Indies* were presently subdued, which likely had not been so easily effected by the *ancient and ordinary Methods of War*. 'Twas this *Thunder and Lightning*, and the *invisible Instruments of Ruine*, that destroyed the *Courage* of those *numerous and hardy People*, took away the *hearts* of the *strongest Resisters*, and made them an *easy prey* to the *Conquering Invaders*.

And now by the gaining that mighty *Continent*, and the numerous *fruitful Isles* beyond the *Atlantick*, we have obtained a *larger Field of Nature*, and have thereby

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an advantage for more Phenomena, and more helps both for Knowledge and for Life, which 'tis very like that future Ages will make better use of to such purposes, than those hitherto have done; and that Science also may at last travel into those parts, and enrich Peru with a more precious Treasure than that of its golden Mines, is not improbable. And so these Engines of Destruction, in a sense too are Instruments of Knowledge. Of the first Author of this Experiment we know no more, but that he was a German Monke, who lighted on it chance, when he was making some Chymical Tryals with Nitre, near about the time of the Invention of the Compass; but his Name and other Circumstances are lost.

Now whoever considers, with the Noble Verulam, how much the state of things in the World hath been altered and advanced by these THREE EXPERIMENTS alone, will conceive great hopes of Modern Experimental Attempts, from which greater matters may be looked for, than those which were the Inventions of single Endeavourers, or the results of Chance.

And of all the Combinations of Men that ever met for the Improvement of Science, there were never any whose Designs were better

better laid, whose *Encouragements* were greater, whose *Abilities* were more *promising*, or whose *Constitution* was more *judiciously* or *advantageously* formed, than the *ROYAL SOCIETY*.

CHAP. XII.

Of the *ROYAL SOCIETY*.

The Reasons of the Institution, and their Designs. An Answer to the Question, What have they done?

T*His Noble Institution, Sir, was the*
THIRD Advantage I mention-
ed, that the *Modern world* hath for the
Communication and *Increase of Knowledge*.
And just as I am come to *this Particular* of
my Method, I find I am happily prevent-
ed, and see I need not say much about it;
For their *HISTORY*, that is newly
come abroad, gives so full and so accurate
an Account of them and their *Designs*, that
perhaps it may be *superfluous* to do more in
This, than to recommend that excellent
H 2 Discourse

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Discourse to your perusal, which I do with some more than ordinary zeal and concernment, both because the Subject is one of the most weighty and considerable that ever afforded matter to a *Philosophical Pen*, and because it is writ in a way of so judicious a gravity, and so prudent and modest an expression, with so much clearness of sense, and such a natural fluency of genuine eloquence: so that I know it will both profit and entertain you. And I say further, that you may remember to do your self this right, That the *Style* of that Book hath all the properties that can recommend any thing to an ingenious relish: For 'tis manly, and yet plain; natural, and yet not careless: The *Epithets* are genuine, the words proper and familiar, the *Periods* smooth and of middle proportion: It is not broken with ends of *Latin*, nor impertinent *Quotations*; nor made harsh by hard words, or needless terms of *Art*: Not rendred intricate by long *Parentheses*, nor gaudy by flanting *Metaphors*; not tedious by wide fetches and circumferences of *Speech*, nor dark by too much curtness of *Expression*: 'Tis not loose and unjointed, rugged and uneven; but as polite and as fast as *Marble*; and briefly, avoids all the notorious defects, and wants none of the

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the proper ornaments of Language. I say, proper; for Styles are *Cloathes* that must be fitted to the Subjects they are upon, and altered according to the *different kinds* of things they describe and express.

Thus, Sir, you see I am not infected with that base Envy, that always speaks detractingly or sparingly of the most worthy Performances of *Contemporaries*. And because of this general ill nature in *Mankind*, few men can bear large commendations of others, though they are never so *just*; but will endeavour to find all the *faults* that *malicious* Wit can suggest, against any thing which hath a great *character* of worth upon it, especially if it be of *modern date*; a *baseness* which no doubt hath been a great discouragement to many noble Designs and Endeavours. For my part, I thank God, I am inclined by my *particular complexion*, as well as by my *Reason*, to take as much pleasure to do *right* to the *deserts* of excellent Things and Persons, as some are to *malign* and *defame* them; and in what I have said on this occasion, I have not only gratified that humour, but I hope done you a kindness, by disposing you to a careful reading of what I have so earnestly recommended: And in *that* you will see

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what were the Reasons of forming such a *Combination* as the *ROYAL SOCIETY*, what is the *Nature* of that *Constitution*, what are their *Designs*, and *what they have done*. You'll find there a *Collection* of some (among numerous others that are in their *Repository*) of the *Experiments*, *Observations*, and *Instruments* which they have invented and advanced for the *Improvement* of *real, useful Knowledge*, and a full *vindication* of the *Design*, from the dark *suspicions* and *objections* of *jealousie* and *ignorance*.

BUT that I may not wholly refer you, which may look like a put-off, I'll here offer you something for a present stay to your *Appetite*, concerning this *Establishment*, as it is an *Advantage* for the *communication* and *increase* of *Science*. I say then, That it was observed by the excellent Lord *Bacon*, and some other *ingenious Moderns*, That *Philosophy*, which should be an *Instrument* to *work* with, to find out those *Aids* that *Providence* hath laid up in nature to help us against the *inconveniences* of *this State*, and to make such *applications* of things as may tend to *universal benefit*. I say, They took notice, that instead of such a *Philosophy* as *this*, *That* which had *usurp'd* the *Name*, and obtained

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obtained in the *Schools*, was but a *combination* of *general Theories* and *Notions*, that were concluded *rashly*, without *due information* from *particulars*, and spun out into unprofitable *niceties*, that tend to *nothing* but *Dispute* and *Talk*, and were never like to advance any *works* for the *benefit* and *use* of men.

This being consider'd, the deep and judicious *Verulam* made the *complaint*, represented the *defects* and unprofitableness of the *Notional* way, proposed *another* to *reform* and *inlarge Knowledge* by *Observation* and *Experiment*, to *examine* and *record Particulars*, and so to *rise* by *degrees* of *Induction* to *general Propositions*, and from *them* to take *direction* for *new Inquiries*, and *more Discoveries*, and other *Axioms*; that our *Notions* may have a *Foundation* upon which a *solid Philosophy* may be built, that may be *firm*, *tite*, and *close knit*, and *suted* to the *Phænomena* of things: So that *Nature* being *known*, it may be *master'd*, *managed*, and *used* in the *Services* of *humane Life*.

This was a *mighty Design*, groundedly laid, *wisely exprest*, and *happily recommended* by the *Glorious Author*, who began *nobly*, and directed with an *incomparable conduct*

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duct of wit and Judgment : But to the carrying it on, It was necessary there should be many *Heads* and many *Hands*, and *Those* formed into an *Assembly*, that might *inter-communicate* their *Tryals* and *Observations*, that might *joyntly work*, and *joyntly consider* ; that so the *improvable* and *luciferous Phenomena*, that lie scatter'd up and down in the *vast Champaign of Nature*, might be *aggregated* and brought into a *common store*. This the *Great Man* desired, and form'd a *SOCIETY* of *Experimenters* in a *Romantick Model*, but could do no more ; His time was not ripe for such Performances.

These things therefore were consider'd also by the later *Virtuosi*, who several of them *combined* together, and set themselves on work upon this *grand Design* ; in which they have been so happy, as to obtain the *Royal Countenance* and *Establishment*, to gather a great Body of *generous* Persons of all *Qualities* and sorts of *Learning*, to overcome the *difficulties* of the *Institution*, and to make a very encouraging and hopeful *progress* in their pursuits. For the account of which particulars, I refer you to the *History*, and only take notice, How ignorantly those *rash* and *inconsiderate* people talk,

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talk, who speak of this *Assembly* as a company of men whose only aim is to set up some *new Theories* and *Notions* in *Philosophy*; whereas indeed, Their *first* and *chief* *Employment* is, carefully to *seek* and faithfully to *report* how things are *de facto*; and They continually declare against the *establishment* of *Theories*, and *Speculative Doctrines*, which they note as one of the most considerable *miscarriages* in the *Philosophy* of the *Schools*: And their business is not to *Dispute*, but *work*. So that those others also that look on them as pursuing *phancyful Designs*, are as *wide* and *unjust* in their ill-contriv'd *Censure*: Since Their *Aims* are to free *Philosophy* from the vain *Images* and *Compositions* of *Phansie*, by making it *palpable*, and bringing it down to the *plain objects* of the *Senses*; For those are the *Faculties* which they employ and appeal to, and complain that *Knowledge* hath too long hover'd in the *clouds* of *Imagination*. So that methinks this *ignorant Reproach* is, as if those that doated on the *Tales* of the *Fabulous Age*, should clamour against *Herodotus* and *Thucydides* as idle *Romancers*. For the main *intendment* of this *Society* is to erect a well-grounded *Natural History*, which takes off the *heats* of *wanton Phansie*,

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she, hinders its *extravagant excursions*, and ties it down to *sober Realities*.

But this, Sir, I only touch *en passant*; and though I am not close upon the *main* thing I intend, yet I cannot forbear taking notice of an *insulting Objection* that we hear frequently in this *Question*, **what have they done?**

To this I could answer in short (as I have once already suggested) more than all the *Philosophers* of the *Notional way*, since *Aristotle* opened his *Shop* in *Greece*. Which Saying may perhaps look to some like a *fond* and *bold* Sentence: but whoever compares the *Repository* of *this Society*, with all the *Volumes* of **Disputers**, will find it neither immodest nor unjust. And their *History* hath given us *Instances* sufficient of their *Experiments*, *Observations*, and *Instruments*, to justify a bolder Affirmation. But I insist not on *this*: The thing I would have you observe is, That those who make the *captious Question*, do not comprehend the *vastness* of the Work of this *Assembly*, or have some *phantaetical Imaginations* of it. They consider not the *Design* is laid as low as the *profoundest Depths* of *Nature*, and reacheth as high as the *uppermost Story* of the *Universe*; That it extends to all the

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the *Varieties* of the great world, and aims at the benefit of *universal Mankind*. For could they expect that such *mighty Projects* as *these* should *ripen* in a *moment*? Can a *Cedar* shoot up out of the *Earth* like a *blade* of *Grass*? or an *Elephant* grow to the *vastness* of his *bulk*, as soon as a little *Insect* can be form'd of a *drop* of *Dew*?

No; The *true* knowledge of *general Nature*, like *Nature* it self in its noblest *composures*, must proceed *slowly*, by *degrees* almost *insensible*: and what *one Age* can do in so *immense* an *Undertaking* as *that*, wherein all the generations of *Men* are concerned, can be little *more* than to *remove* the *Rubbish*, lay in *Materials*, and *put* things in *order* for the *Building*. Our *work* is to *overcome prejudices*, to *throw aside* what is *useless*, and yields no advantage for *Knowledge* or for *Life*; To *perswade* men that there is *worthier Employment* for them, than *tying knots* in *bulrushes*; and that they may be better *accommodated* in a *well-built House*, than in a *Castle* in the *Air*. We must *seek* and *gather*, *observe* and *examine*, and *lay up* in *Bank* for the *Ages* that come after. This is the business of the *Experimental Philosophers*; and in these *Designs* a *progress* hath been made sufficient to satisfy
sober

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sober expectations : But for *those* that look they should give them the *Great Elixir*, the *Perpetual Motion*, the way to make *Glass malleable*, and *Man immortal* ; or they will object that the *Philosophers* have done nothing : for such, I say, their *impertinent Taunts* are no more to be regarded, than the little *chat* of *Ideots* and *Children*.

CHAP. XIII.

An Account of what hath been done by the Illustrious Mr. Boyle for the promotion of Useful Knowledge.

BUT, Sir, I think I am fallen into things of which the *Ingenious Historian* hath somewhere given better *accounts*, and therefore I *draw* off ; though before I quite take leave of this *Head* of my *Discourse*, I think fit yet further to shew the *injustice* of the *Reproach* of having *done nothing*, as 'tis applied to the *Royal Society*, by a *single Instance* in one of their *Members*, who alone hath done enough to oblige all Mankind, and to erect an *eternal Monument*

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Monument to his Memory. So that had this great Person lived in those days, when men Godded their Benefactors, he could not have miss'd one of the first places among their deified Mortals. And you will be convinc'd that this is not vainly said, when I have told you, I mean the *Illustrious Mr. BOYLE*, a Person by whose proper Merits that noble Name is as much adorned, as by all the *splendid Titles* that it wears. And that *this Honourable Gentleman* hath done such things for the *benefit* of the *world*, and *increase* of *Knowledge*, you will see, if you converse with him in his *excellent Writings*, where you will find the *greatest strength* and the *gentilest smoothness*, the *most generous Knowledge* and the *sweetest Modesty*, the *noblest Discoveries* and the *sincereſt Relations*, the *greatest Self-denial* and the *greatest Love of Men*, the *profoundest insight* into *Philosophy* and *Nature*, and the *most devout, affectionate Sense of God* and of *Religion*. And in saying all this, I do not fear the *Envy* that *great praise* excites; for that cannot be so *impudent* to deny the *justice* of *this acknowledgment*.

But, Sir, I consider the commendation of this *incomparable Person* was not the thing

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thing I undertook; but a *succinct* and *general* representation of his *Philosophical Performances*: And to that I now address myself, without more *Preface*.

(1.) In his *Book* of the *AIR*, we have a great *improvement* of the *Magdeburg Experiment*, of emptying *Glass Vessels* by *exsuction* of the *Air*, to far greater degrees of *evacuation*, *ease*, and *conveniences* for *use*; as also an *advance* of that other *famous* one of *Torricellius*, performed by the *New Engine*, of which I have said some things above, and call'd the *AIR-PUMP*. By this *Instrument* (as I have already intimated) the *Nature*, *Spring*, *Expansion*, *Pressure*, and *Weight* of the *Air*; the *decrease* of its *force* when *dilated*, the *Doctrine* of a *Vacuum*, the *Height* of the *Atmosphere*, the *Theories* of *Respiration*, *Sounds*, *Fluidity*, *Gravity*, *Heat*, *Flame*, the *Magnet*, and several other *useful* and *luciferous* Matters, are *estimated*, *illustrated*, and *explain'd*.

And (2.) The great *Doctrine* of the *weight* and *Spring* of the *Air* is *solidly vindicated* and *further asserted* by the *Illustrious Author*, in another *BOOK* against *HOBBS* and *LINUS*.

(3.) In his *PHYSIOLOGICAL* and *EXPERIMENTAL ESSAYS*,
he

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he nobly encourageth and perswades the making of *Experiments*, and collecting *Observations*, and gives the *necessary Cautions* that are to be used in such *Designs*. He imparts a very considerable *luciferous Experiment* concerning the *different parts* and *re-dintegration* of *Salt-petre*; whence he deduceth, That *motion*, *figure*, and *disposition* of parts, may suffice to produce all the *secondary affections* of Bodies; and consequently, That there is no need of the *substantial Forms* and *Qualities* of the Schools. To this he adds a close *History* of *Fluidity* and *Firmness*, which tends mightily to the *elucidating* those useful *Doctrines*.

(4.) In his *SCEPTICAL CHYMIST* he cautions against the sitting down and acquiescing in *Chymical* and *Peripatetical Theories*, which many do, to the great hinderance of the *growth* and *improvement* of Knowledge. He therefore adviseth a more *wary* consideration and *examen* of those *Doctrines*, before they are subscribed; and for that purpose he assists them with many very considerable *Observations* and *Experiments*.

(5.) In his *USEFULNESS of EXPERIMENTAL PHILOSOPHY* he makes it appear how much *that* way

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way tends to the *advance* of the *Power* and *Empire* of *Man* over the *Creatures*, and the *universal* Benefit of the *World*; confirming and illustrating his Discourse with innumerable *new* and *useful Discoveries*.

(6.) In his *HISTORY* of *COLD*, he hath to wonder *cultivated* that *barren* Subject, and improved it (as is noted by the *Philosophical Transactions*) by near 200 choice *Experiments* and *Observations*. He hath there given an account of the *effectiveness* of common *Weather-Glasses*, the *Advantages* of the new *Hermetical Thermometers*, and an *Inquiry* concerning the cause of the *Condensation* of the *Air*, and *Ascent* of *Water* by *Cold* in the ordinary *Weather-wisers*; All which afford valuable *Considerations* of *light* and *use*. But these are only *Preliminaries*: The *main* Discourse presents us with an Account *what Bodies* are capable of *freezing* others, and *what* of *being frozen*; The ways to estimate the *degrees* of *coldness*; How to measure the *intensity* of *Cold* produced by *Art*, beyond that imploy'd in ordinary *Freezing*; In *what* proportion *Water* will be made to *shrink* by *Snow* and *Salt*; How to measure the change produc'd in *Water* between the *greatest heat* of *Summer*, the *first degree* of

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of *winter-cold*, and the *highest* of *Art* ; How to discover the *differing* degrees of *Coldness* in *different* Regions. A way of *freezing* without danger to the Vessel. What may be the *effects* of *Cold*, as to the preserving or destroying the *texture* of Bodies. Whether *specifick* *Vertues* of *Plants* are lost through *congelation*, and then *thawing*. Whether *Electrical* and *Magnetick* *Vertues* are altered by *Cold*. The *expansion* and *contraction* of Bodies by *freezing* ; how they are *caused*, and how their *quantity* is to be *measured*. The strength of the *expansion* of *water freezing*, and an *Inquiry* into the *Cause* of that *prodigious* *force*. The *Sphere* of *Activity* of *Cold*. How far the *Frost* descends in *Earth* and *Water*. An *Experiment* shewing whether *Cold* can act through an *hot medium*. A way of accounting the *solidity* of *Ice*, and the *strength* of the *adhesion* of its *parts* : What *Liquors* are its *quickest* *Dissolvents*. An *Experiment* of *heating* a *cold Liquor* with *Ice*. These, and many more such instructive and useful things, are contained in that excellent *Discourse* : To which is annex'd a very ingenious *Examination* and *Disproof* of the common obscure *Doctrine* of *Antiperistasis*, and Mr. *Hobbs* his *Notion* of *Cold*.

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(7.) In his *EXPERIMENTAL HISTORY* of *COLOURS*, he hath laid a foundation in 150 *Experiments* at least, for *grounded Theory* about these matters. He hath shewn the grand mistake of the common belief, That *Colours inhere* in their *Objects*; and proved they depend upon *disposition* of the *external parts*, and the *more inward texture* of *Bodies*. He hath *stated* and *explained* wherein the *Disparity* consists between the *Real* and *Exphatical*; explicated the Nature of *Whiteness* and *Blackness*; rectified some *Chymical Principles*; compounded *Colours* by trajecting the *Solar Beams* through *tinged Glasses*; shewed how by certain *Tinctures* it may be known, whether any *Salt* be *acid* or *sulphureous*. Hath proved, there is no necessity of the *Peripatetick FORMS* for the production of *Colours*, by making *Green* by nine kinds of *mixtures*; compounded *Colours* *real* and *phantastical*; turned the *Blew* of *Violets* by *acid Salts* into a *Red*; and by the *alcalizate* into a *Green*; and performed many other extraordinary things on this Subject, for the *advantage* of *Knowledge* and the *uses* of *Life*.

(8.) In his *HYDROSTATICAL PARADOXES* he shew'd, That the
lower

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lower parts of *Fluids* are press'd by the *upper*; That a *lighter* may *gravitate* upon one that is more *ponderous*; That if a *Body* *contiguous* to it, be lower than the *highest* level of the *Water*, the lower end of the *Body* will be press'd *upwards* by the *Water* *beneath*; That the *weight* of an *external Fluid* sufficeth to raise the *Water* in *Pumps*; That the *pressure* of an *external Fluid* is able to keep an *Heterogeneous Liquor* *suspended* at the same *height* in several *Pipes*, though they are of different *Diameters*; That a *Body* under *Water* that hath its *upper surface* *parallel* to the *Horizon*, the direct *pressure* it sustains is no more than *that* of a *Columnne* of *Water*, which hath the mentioned *Horizontal Superficies* for its *Basis*. And if the *incumbent Water* be contained in *Pipes* open at both ends, the *pressure* is to be estimated by the *weight* of a *Pillar* of *Water*, whose *Basis* is equal to the *lower Orifice* of the *Pipe* (*parallel* to the *Horizon*) and its *height* equal to a *Perpendicular*, reaching to the *top* of the *Water*, though the *Pipe* be much *inclined*, *irregularly* shaped, and in some parts *broad-er* than the *Orifice*; That a *Body* in a *Fluid* sustains a *lateral pressure* from it, which *increaseth* in proportion to the *depth* of the *immerst* *Body* in the *Fluid*; That *Water* may

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be made to *depress* a Body *lighter* than it self; That a parcel of *Oyl lighter* than *water*, may be kept from *ascending* in it; That the cause of the *ascension* of *water* in *Syphons*, may be explained without the *no-*
tion of *abhorrence* of a *Vacuum*; That the *heaviest Body known* will not sink of it self, without the assistance of the *weight* of the *water* upon it, when 'tis at a *depth* greater than twenty times its own *thickness*, though it will *nearer* the *Surface*.

This is the sum of the general Contents of *that Discourse*, which contains things very useful to be known for the advantage of *Navigation*, *Salt-works*, *Chymistry*, and other *practical* purposes.

(9.) In his Book of the *ORIGINE* of *FORMS* and *QUALITIES*, he delivers the minds of men from the *imaginary* and *useless Notions* of the *Schools* about them, which have no *foundation* in the *nature* of things, nor do any ways promote *Knowledge*, or help *Mankind*; but very much *disserve* those great interests, by setting the *Understanding* at rest in *general obscurities*, or imploying it in *airy niceties* and *Disputes*, and so hindring its pursuit of *particular Causes*, and *Experimental Realities*. In this *Treatise* he lays the *Foundations* and

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and delivers the *Principles* of the *Mechanick Philosophy*, which he strengthen and illustrates by several very *pleasant* and *instructive Experiments*. He shews, That the most admirable Things which have been taken for the *Effects* of *substantial Forms*, and are used as proofs of the *Notional Hypotheses*, may be the results of the meer *texture* and *position* of *parts*; since *Art* is able to make *Vitriol*, as well as *Nature*; and *Bodies* by *humane skill* may be produced, whose supposed *Forms* have been destroyed. He gives many very ingenious instances to prove, That the *Mechanick motions* and *order* of the *Parts* is sufficient to yield an account of the *difference* of *Bodies*, and their *affections*, without having recourse to the *Forms* and *Qualities* of the *Schools*; as in the *restoration* of *Camphire* to its former *smell* and *nature*, after its *dissolution* and seeming *extinction*; in the *changes* of the *colour*, *consistence*, *fusibleness*, and other *Qualities* of *Silver* and *Copper*; in the odd *Phenomena* of a certain *anomalous Salt*, and those of the *Sea-salt*, dried, powder'd, and mix'd with *Aqua-fortis*; and in the *Sal mirabilis*, in the production of *Silver* out of *Gold* by his *Menstruum Peracutum*, in the *transmutation* of *water*

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into *Earth* in a certain *Distillation* of *Spirit* of *Wine* and *Oyl* of *Vitriol*. I say, This excellent Gentleman hath by *Experiments* rare and *new* about these Subjects, made it evidently appear, That the *internal motions*, *configuration*, and *posture* of the *parts*, are all that is *necessary* for *alterations* and *diversities* of *Bodies*; and consequently, That *Substantial* Forms and *real Qualities* are *needless* and *precarious* Beings.

CHAP. XIV.

A further Account of what that Gentleman of Honour hath by him, not yet publish'd, for the Advantage and Improvement of Real Knowledge. The Reasons we have to hope great Things from the Royal Society.

THese, Sir, are some *brief* and *general* Hints of those great things this incomparable Person hath done for the *information* and *benefit* of Men; and besides them,

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them, there are several others that He hath by him, and the Inquisitive expect, in which *real Philosophy* and the World are no less concern'd. I received a late Account of them from an ingenious Friend of his, Mr. Oldenburgh, Secretary to the *ROYAL SOCIETY*, who also renders himself a great Benefactor to Mankind, by his affectionate care, and indefatigable diligence and endeavours, in the maintaining *Philosophical* Intelligence, and promoting the Designs and Interests of *profitable* and *general* Philosophy. And *these* being some of the *Noblest* and most *Publick* Employments, in which the Services of generous Men can be engaged, loudly call for their Aids and Assurances, for the carrying on a Work of so *universal* an importance.

But I shall have a fitter place to speak of *this*, and therefore I return to the *Illustrious* Person of whom I was discoursing. And for *Philosophical News*, and further evidence of the *Obligation* the World hath to this Gentleman of Honour, I shall give you the List of what he hath more, yet *unpublished*, for its advantage and instruction. And I take the boldness to do it, because himself hath been pleased to *quote* and refer to those Discourses in his publish'd Writings; con-

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cerning which, the generous *Secretary's* Account is more *particular*, and he receiv'd it from the Noble Author's *immediate* information. It speaks thus.

(I.) Another *Section* of the *Usefulness* of *Experimental Philosophy*, as to the *Empire* of *Man* over *inferiour* Creatures; where he intends to premise some *general Considerations* about the *Means* whereby *Experimental Philosophy* may become *useful* to *Humane Life*; proceeding thence to shew, That the *Empire* of *Man* may be promoted by the *Naturalists* skill in *Chymistry*, by his skill in *Mechanicks*, or the *Application* of *Mathematicks* to *Instruments* and *Engins*; by his skill in *Mathematicks*, both *pure* and *mixt*: That the *Goods* of *Mankind* may be much increased by the *Naturalist's* insight into *Trades*; That the *Naturalist* may much advantage men, by exciting and assisting their *curiosity* to *discover*, *take notice*, and make use of the *home-bred Riches* and *Advantages* of *particular Countries*, and to increase their number, by transferring thither *those* of others; That a *ground* of high *expectation* from *Experimental Philosophy* is given, by the happy *Genius* of *this present Age*, and the *productions* of it; That a *ground* of expecting considerable things from

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from *Experimental Philosophy* is given by those things which have been found out by *illiterate Tradesmen*, or lighted on by *chance*; That some *peculiar* and *concealed* property of a *natural* thing, may inable the *knowers* of it to perform, with *ease*, things, that to others seem either not *feasible*, or not *practicable* without great *difficulty*; That by the *knowledge* and *application* of some *unobvious* and *unheeded* *Properties* and *Laws* of *natural* things, divers *Effects* may be produced by other *means* and *Instruments* than those one would judge *likely*; and even by *such*, as if proposed, would be thought *unlikely*; That the *knowledge* of *peculiar* *Qualities*, or *uses* of *Physical* things, may inable a man to perform those things *Physically*, that seem to require *Books*, and *dexterity* of hand proper to *Artificers*; That the *uses* of scarce *one* thing in *Nature*, to *Humane* Life, are yet *thorowly* understood; That a great *Inducement* to hope for considerable matters from *Experimental Philosophy*, may be taken from the *mutual* assistance that the *Practical* and *Theoretical* part of *Physick* may be brought to afford each other; That we are not to make our *Estimates* of what may be *hoped* for hereafter, when men shall be assisted with the *History* of *Nature*, a *method* of

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of imploying it, and true *Principles of Natural Philosophy*, and *associated Endeavours*, by what is already performed without any of those *Assistances*. (2.) He hath also in a manner promised *Essays* touching the *concealments* and *disguises* of the *Seeds of living Creatures*. (3.) An *Appendix* to the *Physico-Mechanical Treatise* concerning the *Air*. (4.) *Something* concerning *Heat and Flame*. (5.) The *Sceptical Naturalist*, shewing the *imperfections* of *Natural Philosophy* as we yet have it. (6.) A *Discourse of improbable Truths*. (7.) The *production of Qualities by Art*. (8.) *Several useful Series of Inquiries and Directions* of his, whereof divers are extant in the *Philosophical Transactions*; as, (1.) *General Heads for a Natural History of a Country small or great*. (2.) *Observations and Directions about the Barometer*. (3.) *Inquiries touching the Sea*; and, (4.) *About Mines*. (5.) *Queries and Tryals* proposed, for the improving of that *Grand Experiment*, for the *transfusing Blood* out of one *live Animal* into another. (6.) *Others* for the finding the *Effects* of the *Rarifying Engine* exhausted, in *Plants*, *Seeds*, and *Eggs of Silk-worms*. Besides *These*, he hath a great many other *unpublis'd Inquiries*,

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ries, and *Series of Experiments and Observations* of the most considerable parts of *Natural Philosophy*. As, (1.) About *Precious Stones*. (2.) *Fermentation*. (3.) *Heat and Flame*. (4.) An Account of a *new* kind of *Baroscope*, which he calls *Statistical*, and the advantage it hath above the *Mercurial*. (5.) A *New Experiment*, shewing how a considerable degree of *Cold* may be suddenly produced without the help of *Snow, Ice, Hail, Wind, or Nitre*, and that at any time of the year, *viz.* by *Sal Armoniack*. (6.) A way of preserving *Birds* taken out of the *Eggs*, and other small *Fœtus's*.

This, Sir, is the Account I received of that *Noble Person's* further Designs, for the advantage of useful Knowledge; and though he hath not made an *absolute* Promise of those Discourses to the *Publique*, yet he is known to have *such*, and they are with *probability* expected, since he is *too generous* to detain from the *capable and inquisitive* those his *excellent Discoveries*, which tend to the *common Benefit*. And thus I have said what may suffice for general Information about the *ROYAL SOCIETY*, and the hopes we may justly conceive of *this Constitution*. And in what I have discoursed, I have not so much declined

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clined from the *proof* of my *undertaking*, which was to shew the *advantage* that *this latter Age* hath, for the promotion and increase of *Knowledge*, above those of former Times: For by describing the *Reasons*, *Nature*, and some of the *Effects* of *this Establishment*, I have not *obscurely* suggested the Helps that the World hath and may expect from *Them*, for those *Grand* and *Catholick Purposes*; and 'tis easie to see in the very *frame* of this *Assembly*, that they are fitted with Opportunities to amass together all the considerable *Notices*, *Observations*, and *Experiments*, that are scattered up and down in the *wide World*; and so, to make a *Bank* of all the *useful Knowledge* that is among men. For either by their *whole Body*, or *some* or *other* of their *particular Members*, they hold a *Learned Correspondence* with the greatest *Virtuosi* of all the known *Universe*, and have several of their own *Fellows* abroad in *Forreign Parts*, by reason of whose *Communications*, they know most of the *valuable Rarities* and *Phenomena* observed by the curious in *Nature*, and all *considerable Attempts* and *Performances* of *Art*, *Ingenuity*, and *Experiment*. To which consideration, if you add the *inquisitiveness* of their *Genius*, and the *way* of their *Procedure*,

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cedure, by particular and cautious Observation; the coldness and shiness of their Assent, and the numbers of judicious men that carefully examine their Reports; I say, If these Particulars be weighed, it will appear to the unprejudiced, That the World had never such an advantage for the accumulating a Treasure of substantial Knowledge, as it hath by this Constitution; for single Inquisitors can receive but scant and narrow Informations, either from their own Experience, or Converses; and those they have, are frequently very imperfect, or very mistaken: There is often either vanity or credulity, ignorance or design in their Relations, which therefore are many times false in the main matter, and oftner in the circumstance: So that the Histories of Nature we have hitherto had, have been but an heap and amassment of Truth and Falshood, vulgar Tales and Romantick Accounts; and 'tis not in the power of particular unassociated Endeavours to afford us better. But now, the frame of this Society suggests excellent ground to hope from them sincere and universal Relations, and the best grounded and most useful Collection of the affairs of Art and Nature, that ever yet was extant. And as they have peculiar Priviledges for the gathering

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gathering the *Materials* of Knowledge, so They have the *same* for the *impartment* and *diffusion* of them. And by this time I hope you will acknowledge, That I have made good also what I undertook in *THIS* my *last* and *Great Particular*.

CHAP. XV.

The Absurdity of making Comparison between the Advantages Aristotle had for Knowledge, and those of later Ages.

THUS I have shewed in *plain* and *material* Instances, the *vanity* and *weakness* of the **Disputer's** *Affirmation* and belief, That *Aristotle* had more *Advantages* for *Knowledge* than all the *later Ages*. And so I have done with *his Proposition*: But his *Reason* also is to be *considered*, and that *was*,

Aristotle had *these Advantages* above all the *World*, because he did **Totam per-agrare Asiam**. How wisely said and concluded this was, will appear after we have

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have taken notice, that his *Reason* is defective both in what it affirms, and in what it would infer. For the first, 'tis evident, that *Aristotle* and the *Ancients* did not know all *ASIA*; for that part which lay beyond the River, was in a manner a *Terra Incognita* unto them: so that they knew scarce any thing of the *Indies* that lie on the other side of *Ganges*, little or nothing of the vast Kingdom of *China*, nothing of *Japan*, or the numerous *Oriental Islands*, besides the defects in the ancient *Geography*, noted above; and these made a great if not the best part of *Asia*; of which though *Aristotle* might have heard, yet we have no shadow of Reason to believe he had any Information from thence. And then I consider,

(2.) That the Account he had from the best survey'd Regions, were but from *Hunters*, *Fowlers*, *Fishermen*, and such kind of *Inquisitors*, who were like enough to make vain and mistaken Reports, and he was fain to depend upon the credit of their *Relations*; and therefore his *History of Animals* contains many things that are frivolous, and many that are palpably false. To which I add,

(3.) The Observation of my Lord Bacon,

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con, That though *Aristotle* made some use of those *Experiments* and *Observations* he had from those *Informers*, yet it was after he had concluded and decreed. For he did not use and imploy *Experiments* for the erecting of his *Theories*: but having arbitrarily pitch'd his *Theories*, his manner was to force *Experience* to suffragate, and yield countenance to his precarious *Propositions*. And on this account, the Great man saith, he was less excusable than the *Schoolmen*, who altogether quitted and neglected the way of particular *Industry* and *Experiment*. Thus then *Aristotle* neither knew all *Asia*, nor had certain *Relations* of that part thereof, of which he had the best Informations; nor did he use those he had as he ought; which were enough to bring the **Disputers** Reason to nothing. But I consider further, That though these things had been otherwise, and as much for the interest of his *Affirmation* as he could wish, yet,

(2.) His *Inference* must fail, since the latter Ages have a much larger World than *Aristotle's Asia*; We have the *America*, and the many New Lands that are discovered by *Modern Navigators*; we have larger and more perfect *Geography* even of the old World, infinitely more acquaintance

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acquaintance and better correspondence in all the parts of the Universe, by our general Traffique; than the Ancients, whose Commerce was narrow, and knowledge of remote Parts consisted but in hearsays and doubtful Rumors. We have besides, New Heavens as well as a New Earth, a larger and truer prospect of the World above us. We have travell'd those upper Regions by the help of our Tubes, and made Discoveries more becoming the wisdom and Magnificence of our Creatour, and more agreeable to the appearances of things, than the arbitrary phantasies and conjectures of Aristotle and his Schools. We have a greater world of Arts, Instruments, and Observations, as in all Particulars my Discourse hath made good. And what are Aristotle's peragrat-ions of Asia, to all these? To the great Western Indies; to the full and clearer knowledge of the Ancient Lands; to those nobler Accounts we have of the Heavens, and universal Nature; to our vast Improvements of Chymistry, Anatomy, Arithmetick, Geometry, Astronomy, Geography, Opticks, Natural History, Navigation, and all things else of benefit and instruction? I say, what are the gleanings of a few mercenary Hunters, Fowlers, and Fishermen, over one part

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of *Asia*, to *these* Advantages? And what are the *Reports* of a *few* ordinary *Fellows*, and the *Tryals* of a *single* *Person*, to the learned *Inquiries* and *Endeavours* of *many* *sagacious* *inquisitive* *Ages*, and the performances of a *numerous* *Company* of *deep*, *war*y, *diligent*, and *eagle-ey'd* *Philosophers*, who have the help of *those* *Observations*, and the addition of an *infinite* *number* *more*?

Upon *these* accounts, Sir, the **Disputer**, you see, will need a great deal of *Logick* to make *any* *thing* of his *Proposition* or his *Reason*, both of which are very *lame*, and I know not where he can find a *prop* for their feebleness. I shall not therefore employ *more* force to overthrow such *sickly* *Reasonings*, that have not strength enough to bear their own weight; but out of *pity* to those *infirmities*, shall let them go without *further* castigations. And I hope you have not so understood me, as if the aim of what I have said *hitherto*; was only to disprove this **Disputer** (which were a *poor* project, and would signify but *very* *little*.) But my Design is, by representing the *advantages* and *hopefulness* of the *Modern* *way*, to kindle an ardour in you towards the *generous* *Experimental* *Researches*, to vindicate *Philosophy* from the *imputation*

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tation of being *notional* and *unprofitable*, and to keep you from adhering to that which is *so*, and hath been the occasion of the *scandal*. And as for *those* that yet stick *there*, I have some things to observe concerning the *Reasons* of their *Devotion* to that *aiery disputative Philosophy*, and their *Enmity* to the *Practical*.

CHAP. XVI.

The Reasons of some Mens Superstitious Adherence to the Notional way; and of the Disputer that gave occasion to this Discourse.

I Consider then, That *easy Youth* in its first addresses to Learning, is perfectly *passive* to the *Discipline* and *Instructions* of its *Teachers*, whose *Documents* are *promiscuously* received with ready submission of *Understandings*, that *implicitly* depend on *their Authority*. We suck in the first *Rudiments* as we do the *common Air* [*facili haustu*] as my Lord Bacon expresseth it, *without discrimination or election*, of which indeed

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our tender and unexercis'd minds are not capable. And, I confess, 'tis *necessary* we should do so; nor were there any hurt in this *innocent* easiness, did not most men *all their lives* worship the *first* thing they saw in the *morning* of their *days*, and *ever after* obstinately adhere to those unexamined Receptions. But *this* is the *mischief*, we infinitely *believe every thing* when we are *Children*, and *most* examine little when they are *Men*, but *settle* in their *first impressions*, without giving themselves the *trouble* to *consider* and *review* them. And *these* prejudices by *custom* and *long acquaintance* with our Souls, get a *mighty* interest, and shut them against every thing that is of a different colour from those *Images of Education*. This is a *general fault* and *infirmity* of *humane Nature*, and from hence it comes to pass, that the tutour'd *Youth* slides *easily* into the belief of the *first Principles* of *Philosophy*, which they are taught, and are confirm'd in them by their *Exercises* and *Disputes*, and *Books* and *Converses*: By *these* their *Understandings*, which *before* were *white-Paper*, are *died* and *deeply tinctured* by the colour they have *imbibed*; And *these infusions* insensibly grow as 'twere into the very *substance* of the Mind, and are
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upon all occasions appealed to as its *unprejudiced, unsophisticate Dictates*. So that having spent some time in *learning and trimming* those Notions, *the most* divert to *Business* or other Studies, without troubling themselves with any more *Philosophical* pursuits; but being satisfied with those *Notices* which their *first* Education lodg'd in their Minds, they seek no *further*, nor do care to be *wiser* in those matters, than they were in the *disputing infancy* of their Knowledge.

All this while no other *hurt* is done, but that men thus are injurious to *themselves*, and hinder their *own* Improvements. But 'tis *much worse* when they fondly *fix these* as the *Pillars of Science*, and would have no body *else* go further than their *laziness* or their *cares* will permit them to travel; but *rail* spitefully at all Endeavours for the advancement of *Philosophick wisdom*, and will be angry with every one that hath outgrown his *Cherry-stones* and *Rattles*, speak evil at a *venture* of things they know not, and like *Massives* are *fiercer* for being kept dark. These are the great Enemies of the *useful, experimental Methods of Philosophy*: They take it ill that *any thing* should be accounted valuable, in which they are un-

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instructed.

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instructed, being loth to *learn* in an Age wherein they expect to *Dictate*; and the *Satyr*ist hath told them another reason.

—*Turpe putant parere minoribus, & quæ Imberbes didicere, senes perdenda fateri.*

I will not say how much of *this* I take to be the case of our **Reverend Disputer**; only this, He imployed his *younger* Studies upon the *Philosophy* of *Disputation*, and, 'tis like, gained an ability to out-talk *many* of his *Contemporaries* in *that* way. He *confirm'd* himself in these *Notions* by instructing *others* in them, and upon *these* Foundations hath built himself the Reputation of a *great Scholar* and a *Disputant* among his *Country-Admirers*. So that you are not to wonder that he is *vehemently* displeased with the *ROYAL SOCIETY*, and *Experimental Philosophers*, since their Designs take away the *honour* of his *Craft*, and in *this way* he is upon the same *level* with those that are *but beginning*; the thought of which must needs be distasteful to a *self-assured* and *imperious* mind. And yet because you shall not think that I say any of this out of envy to his *Fame*, I shall do him all the right I can, by acknowledging, That I take him for a Person that under-stands

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stands the *Quiddities* and *Haccetities*, the *Præcisiones formales* and the *Objectiva*, the *Homogeneities* and *Heterogeneities*, the *Catagorematicæ's* and the *Syncatagorematicæ's*, the *Simpliciter's* and the *Secundum Quid's*. He knows, no doubt, that *First Matter* that is neither *Quid*, nor *Quale*, nor *Quantum*; and that *wonderful Gremium materia*, out of which *Forms* were educed that were never there. He can tell you fine things of the *fiery Element* under the *Moon*, and the *Epicycles* of the *Stars*; Can resolve all *Questions* by the *compendious* way of *Formaliter*, *Materialiter*, *Fundamentaliter*, and *Eminentèr*; Tell you the difference between *Quodam modo* and *Modo quodam*, and shew the causes of all things in *Sympathy*, *Antipathy*, *Combination* of the *Elements*, and *Influences* of the *Heavens*. He sees clearly by his *Spectacles*, That the *Milky-way* is but a *Meteor*, and *Comets* only kindled *Vapours*, in spite of the *contrary* information of the *deceitful Telescopes*. He can, no doubt, dispute roundly about the *composition* of *Entia rationis* and *Universals*, the *Prædications* of *Genus* and *Species*, and the *manner* of their *conservation* in *Individuals*; of the number of the *Prædicaments*, and *what Being* is in *this*, and *what* in another; of the *inherence* and *pro-*

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pagation of *Accidents*, the *real* essence of *Relations*, the *nature* of *Ubi* and *Quando*, and a thousand other *Logical* tricks about *shuffling* and *ordering* *Propositions* and *forms* of *Syllogism*. In *Physiology* he can discourse of the *nakedness* of *First Matter*, the *edu-ct*ion of *Forms* out of its bosom; shew, that the *want* of a *Being* is a *Principle* of it, how *forms* of *Elements* are *refracted* in *mix'd Bodies*; Dispute subtilly about the *Primum incipiens* in *Motion*, the *instantane-ousness* of *Generation*, the *Maximum quod sit*, and the *Minimum quod non*, and infinite more of such *wonderful*, *useful*, *significant* *Speculations*. And in the *Metaphysicks* I acknowledge him in the words of the incomparable Droll;

*He knows what's what, and that's as high
As Metaphysick wit can fly.*

These, and other such *profundities*, are some of the *main* things of that *Philosophy* to which our **Disputer** is so *zealous* a *Vo-tary*. But for the *Mechanick*, that attempts *material* and *intelligible* *Accounts* of things, and is in its *grounds* much *ancienter* than that of *Aristotle* which he admires, for the *Experimental* *Methods* and *late* *Improve-ments*

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ments of *useful Knowledge*; as for *these*, I say, I had no reason to judge by his Discourse that he had *any acquaintance* with them; nor doth he, as far as I can perceive, *pretend it*: But having it seems concluded, That nothing more was to be *known*, than he *knew*, when he *disputed* in the Schools, he hath *sate down* ever since, and *hugg'd* himself in his own *Omni-science* and *Infallibility*, without caring to be *informed*, what the *inquisitive World* hath been *doing* in this *late Age of Inquiry*. And if it be any thing more than what he hath understood in his *Circle of Disputations*, 'tis *phantastical* and *unprofitable*, and not worthy his *care* or *notice*, which is very *prudently* concluded; For if it should be otherwise, the **Disputer** would lose the credit of his *Superlative Learning*.

CHAP.

CHAP. XVII.

Of the Peripatetick Philosophy, and Aristotle, as he concerns the Universities.

AND on this occasion, Sir, I observe the *incompetency of their judgements* who are *Enemies to the Real Experimental Philosophy*, in that they do not (as I intimated) *at all, or very little, understand what they condemn*. This I have some reason to say, since in the whole compass of my Acquaintance, which is not very narrow, I profess I know not *one* who opposeth the *Modern way*, that is not *almost totally unacquainted with it*. And on the other side, upon the most careful turn of my thoughts among my *Philosophick Friends*, I cannot light on *one* of all those that are for the *Free and Experimental Procedure*, but who have been very well instructed in the *Peripatetick Doctrines*, which they have deserted, and *most of them* much better than those who are yet *zealous Contenders* for them.

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And for my *own* part, I must confess, that in my *younger* and *Talkative* Age, I was much delighted with those *subtilties* that exercise the Brain in the *niceties* of *Notion* and *Distinctions*, and afford a great deal of *idle Employment* for the Tongue in the *Combates* of *Disputation*: In which I acknowledge I was none of the most *backward*, but being highly pleased with those engagements, I found as much diversion in them, as in my dearest Recreations: Yea, and in this *Recital* methinks I feel a kind of *sweet relish* upon my mind, of those *past Complacencies*. But after I had spent some years in those *Notional* Studies, perhaps with as good success as some others, I began to think *CUI BONO*, and to consider what *these* things would signify in the World of *Action* and *Business*, I say, I thought; but I could find no encouragement to proceed from the Answer my thoughts made me: I ask'd my self what accounts I could give of the *works* of God by my Philosophy, more than those that have none, and found, that I could amaze and astonish Ignorance with *Distinctions* and words of *Art*, but not satisfy ingenious Inquiry by any considerable and material Resolutions. I consider'd I had got nothing all this

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this while, but a certain *readiness* in talking, and that about things which I could not use *abroad*, without being *Pedantick* and *ridiculous*. I perceived that *that Philosophy* aimed at *no more*, than the *instructing* men in *Notion* and *Dispute*; That its *Design* was *mean*, and its *Principles* at the *best uncertain* and *precarious*; That *they* did not agree among *themselves*, nor at all with *Nature*. I examined the best Records I could meet with about the *Author* of those *current Hypotheses*, but could not be *assured* that *Aristotle* was *he*. I saw many Reasons to believe, that most of the *Books* that bear *his Name*, are *none of his*; and *those* that are most *strongly* presumed to be *so*, are mightily *altered* and *corrupted* by *Time*, *Ignorance*, *Carelessness* and *Design*. I perceived that the *Commentators* and late *Disputers* had exceedingly *disguised* and *changed* the *Sense* of those very Writings, and made up a *Philosophy* that was *quite another thing* from *that* which *those* Books contain. So that by *these* means I was by degrees taken off from the *implicit Veneration* I had for *that Learning*, upon the account of the great Name of *Aristotle* which it wore. And in the process of my *Inquiries*, I lighted upon several excellent Authors, who

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said and proved very evil things of that Philosopher himself; As, That he was *impious* in his *Life* and many of his *Doctrines*, a *Persecutor* of the most venerable Sages, and *corrupter* of the *wisdom* of the *Ancients*; That he was of no such *superlative* account in the *wisest* Times, but much *opposed* and *slighted* by the *First Fathers*; That he grew into his *Magisterial Authority* by *chance*, in *Times* of *blackest Ignorance*, and held an *unjust Empire* over the free-born *Minds* of *Men*, who since they are *enlightened* by the *Rays* of the *glorious Gospel*, have less reason to bow down to the *Dictates* of an *Idolater* and an *Heathen*. I say, I found *these things*, and *many more*, urged against the *School-Philosopher*, by men of great *Learning* and *Name*. Nor could I ever light on any thing in his most *devoted Admirers*, that tended to the answering or disproof of any of those *grand Accusations*, most of which seemed to me to have too much evidence, to be easily disabled; not to mention how many *Reasons* I saw my self for the *worst* of those *Characters*, in the *Books* that are ascribed to him, if *really they are his*.

These things then I *ponder'd*, and in the *heat* of my *Thoughts*, and a *youthful Indignation*,

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dignation, I drew up the *Charge*, and gave in the full of those *bold Accounts* to the *Publick*, in a *Letter* about *Aristotle*, which perhaps you will not do amiss to *consider*. Thus the great *impediment* was removed, and the prejudice of *Education* overcome, when I *thought* further, That *useful Knowledge* was to be look'd for in *God's great Book* the *Universe*, and among those *generous Men* that had convers'd with *real Nature*, *undisguised* with *Art* and *Notion*. And still I saw *more* of the *justice* of the excellent *Poet's* *Censure* of the *Sons* of *Aristotle*, when he saith,

*They stand
Lock'd up together hand in hand:
Every one leads as he is led,
The same bare path they tread,
And dance like Fairies a phantastick Round;
But neither change their Motion, nor their
(ground.*

From *this Philosophy* therefore, and *these Men*, I diverted my eyes and hopes, and fixt them upon *those Methods* that I have recommended, which I am sure are liable to none of those *Imputations*.

And here I think fit to add a *Caution* which I have given in another *Discourse*, and do it once more to prevent a dangerous

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rous misunderstanding, viz. [And it is, That I have said nothing of this to discourage *young Academians* from applying themselves to those *first Studies* which are in use in the *Universities*. Their *Statutes* require *Exercises* in that way of *Learning*; and so much knowledge of it, as inables for those *Duties*, is *requisite* and *fit*. Nor do I deny, but that those *Speculations* raise, quicken, and whet the *Understanding*, and on that account may not be altogether *unprofitable*, with respect to the more *useful Inquisitions*; provided It keep it self from being *nice*, *aiery*, and *addicted* too much to *general Notions*. But *this* is the *danger*, and the *greatest part* run upon the *Rock*. The *hazard* of which might in great measure be avoided, if the *Mathematicks* and *Natural History* were mingled with *these other Studies*, which would indeed be excellent *Preparatives* and *Dispositions* to *future Improvements*. And I add further, that the *young Philosophers* must take care of looking on their *Systematick Notions* as the *bounds* and *perfections* of *Knowledge*; nor make account to *fix eternally* upon those *Theories*, as *establish'd* and *infallible Certainties*: But consider them in the *modest sense* of *Hypotheses*, and as *things* they are

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to take in their passage to *others* that are more *valuable* and *important*. I say, the *Peripatetick Studies* thus *temper'd*, will not, I suppose, be *disfallow'd* by the men of the *Practical Method*; and so the *University-Establishments* can receive no prejudice from the *Spirit* that dislikes a *perpetual acquiescence* in the *Philosophy* of the *present Schools*.

CHAP. XVIII.

Some things else debated by the Author with the Disputer, about the Prophets and the Scriptures. The Imagination was ordinarily the immediate Subject of Prophetick Influx.

I HAVE now done with the *Philosophical Considerations* I intended here, and am so fond as to believe, that I have said enough about the *main business* of our *Conference*; from which the *Disputer* at last shew'd an inclination to draw off, and endeavour'd

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endeavour'd to engage me in other things that were *aside* and *irrelative* to our Discourse: Particularly, I perceived he made towards the Controversies between the *Calvinists* and *Remonstrants*, and offer'd me several Temptations to fall in there. I knew it was a Design to draw me into his Road of *talking*, and consider'd that our *Spirits* were too much *moved*, and our *Time* too *short* for those *deep* and *endless* Debates. And I have long since resolved never to treat with any one about *them*, that is, not very *free*, *thoughtful*, *modest*, and *benign*, without which *prædispositions* in the Subject, I know the *clearest* and *greatest* evidence in the World can make no *impressions*. Upon these accounts I declined the bait; but in the process of our *rambling* Talk, was insensibly led into a Discourse as *extrinsic*, which was concerning the *Method of the Scriptures*. About this I said,

That those Holy Oracles were not written methodically; Meaning, not according to the *Rules of our Methods*; especially *instanc'd* in the *Prophetick Writings*, which are very
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little suited to the *ways* of our *Order*. And in consequence of *this*, I affirmed, *That God was pleased in those Inspirations to apply himself much to the Imagination of the Prophets*; which *Faculty*, I said, was *desultory*, and did seldom *tie* it self to *strict coherence*. This was the *sum* of *all* from whence the **Disputer** took occasion for *loud* out-cries. He told me, [**That my Affirmations were Atheistical; That God was the God of Order, and not of Confusion; and dealt with the noblest Faculty, which is the Understanding**] I was astonish'd at the haste of the *wilde* and *groundless Censure*, and answered to the *Argument*, That he might as well conclude, That all the *Blades of Grass, and Flowers of the Field, should be placed in Knots, and a Garden-order, and the Stars set in Rank and File, because God is the God of Order*, as the other Proposition he would infer.

I said there was no doubt but that the Divine Wisdom, which had made all things in *Number, Weight, and Measure*, had

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had an *Order* and *Idea* to it self, according to which it framed them: But then I added, That as *his ways* were *above ours*, so were many of the *Methods* of his *working* besides them; and consequently, I thought it somewhat too bold and *presumptuous* to bring down *Infinite Wisdom* to our *Rules*, upon that score reproving the Custom of some *Formal Preachers*, who spend much pains to little purpose, in finding long *Series of connection*, where many times none were intended.

This is the whole substance of what I said in this Affair, and at this *period* of the Conference the **Disputer** lost all patience, and with sufficient *spight* and *rage* told me, **That I was an Atheist**; That he had indeed desired my Acquaintance, but would have no more on't; and so turn'd his back, and went away, giving me time only to *Answer*, That I had no great reason to lament the loss of an Acquaintance that could be so easily forfeited. Thus, Sir, you have the sincere Account of those *Sayings*, about which the **Disputer** hath raised such *Tragical Stories*. In them he hath accused me of *Atheistical Assertions*; and affirmed that I said, **The Scripture was only written to mens phantasies:**

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Which *Proposition* he hath so ordered, as that many *impious* absurdities are deduced from it, and *these* must go for my Opinions. When as 'tis so far from being *true*, that *that Proposition* came from me, that I understand not what it *means* : Only I can collect from it the **Disputers** *wrath*, or *somewhat* he would be less willing to acknowledge. For either he *really believes* the *Proposition* he reports, to be the sense of *mine*, or he doth not; If really he doth, I cannot excuse his *Understanding*; if *not*, I wonder at his *Conscience*. But that I may together *explicate* what I *meant*, and *defend* it, I add a brief account of my Saying, *[That God did much apply himself to the Imagination of the Prophets;]* As to which, I observe,

That both the *Schoolmen* and others usually divide *Prophesie* into *Intellectual* and *Imaginary*. The former is from a *Light immediately infused* into the *Understanding*; the latter, when the *Prophetick Spirit* makes its *first Impressions* on the *Imagination*, by *Sensible* and *material Representments*. As for the *First*, it was so rare, that

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that not above *one* or *two* Instances are produced by the Learned in the kind, *viz.* *MOSES* and *St. PAUL*. Now commonly the degree of *Mosaical Inspiration* was distinguish'd from the *Prophetical*; and the difference is plainly enough express'd *Deut. xxxiv. x.* And there arose not a Prophet since in *Israel* like unto *MOSES*, whom the Lord knew face to face. For the other Prophets, God saith, *I will make my self known unto him in a Vision, and will speak unto him in a Dream: My Servant Moses is not so, with him I will speak mouth to mouth*, *Num. xxii. v, vi.*--- intimating a transcendent Privilege to *Moses* above the Prophets, in the immediate way of application to his mind, without the mediation of sensible Impressions. And upon this account 'tis said in the *New-Testament*, *They have Moses and the Prophets*; implying the difference of the dignity and degree of their *Inspiration*.

As for the second Instance of *St. Paul*, his case mentioned *ii Cor. xii.* was *Extasie*, and may be omitted in our Discourse that concerns *Prophetick Revelation*; But admitting it, this must be granted however, That the *immediate Intellectual* way was very rare, and therefore by way of emi-

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nency and distinction, 'tis among the Rab-
bins call'd the *Gradus Mosaicus*.

But for the *second kind, viz. the Imaginary and Sensible*, this was the *ordinary* sort of *Inspiration*, and this the meaning of my Assertion. That it was the usual way of *influx* upon the *Prophets*; appears from the mentioned place of *Deut. xxxiv. And I will make my self known unto him in a Vision, and speak unto him in a Dream*; which was most evidently fulfilled in the *latter days* of *Prophecie*, when the *Prophetick Illuminations* went much *this way*. It might seem superfluous labour to give *particular Instances* in *Jeremiah's Boyling Pot, his Rod, his Basket of Figs---* In *Daniels Tree and Four Beasts---* In *Ezekiel's Chariot, wheels, Living Creatures---* and such like, which in the *Prophetick Writings* scarce leave a page without example. Now it will not I conceive be denied by any one that understands what he *saith*, that these *Representations* were made upon the *Stage of Imagination*, and those *Visa* impress'd on the *Phancy*. Upon this account it was that the *Enthusiasms* of later *Prophets* were much in *Similitudes, Parables, and Allegories*; and so *Ezekiel* complains, *Ah Lord, they say of me,*

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me, Doth he not speak in Parables? And a Lapide gives it for a general Rule, *Prophetarum Visiones & Revelationes communiter fuerunt Sensiles, sive Imaginariae.* Rabbi Albo calls Propheſie an Influence from God upon the Mind by the mediation of the Phancy; and Maimonides ſaith, That all the Degrees of Propheſie are contain'd in thoſe two, a Dream and a Viſion; and Joel ii. xxviii. mentions theſe as comprehenſive of all the Degrees of Propheſie. But this thing is every where ſo clear in the Scripture, in the Rabbins, and the Writings of all Learned men that deal in thoſe matters, that I think I need not ſay much more for proof.

Only I take notice, That 'twas the general belief of the *Jewiſh* Writers, and of the *Chriſtian Fathers* and *Schoolmen* univerſally, confirm'd by the Authority of Scripture, That Angels were ordinarily the immediate Efficient by whoſe Miniſtry the Scene of Propheſie was dreſt and order'd. This hath been evidently proved by the Learned Mr. Smith, in his Diſcourſe of Propheſie; and from hence I could infer, if there were need of more, That their menage of this Affair doth reaſonably infer, That the Imagination had ſuch a concern in

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it as I affirm. For 'tis generally denied by the Schoolmen, whose *Authority* no doubt is great with our **Disputer** and others, That *Angels* can *immediately imprint Conceptions* and *Apprehensions* on the *Understanding*; which indeed, among other absurdities that I omit, would infer, That they have that grand Prerogative of the *Omniscient*, the *Κατ'οικονομίαν*, *Knowledge of Hearts*, which the Scripture every where vindicates and appropriates to *God only*. What they do therefore, must be by *Phantasms* and *Idea's* impress'd on the *Phancy*. They are the *Internuncii* and *immediate Causes* which present the *Prophetick Visa*; and consequently, the *Imagination* and *Sense* are the chief *Stage* of their *Representations*. Now this was done *divers ways*, and the noble *Picus Mirandula* hath collected out of *Maimonides* no less than *eleven*, all which he calls *Gradus Imaginarii*, in opposition to the *Gradus Mosaicus*, which is the *Intellectual*.

But 'tis not proper for me to insist longer on a thing that is *extrinsick* to the *main* design of my Discourse. And it was too
but

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but the *Conclusion* and *smallest* part of our Conference; Though the **Disputer** (as far as I can hear) *reports* nothing else as the *matter* of our difference, but these two things, about the *Method of Scripture*, and *Gods applying to the Imagination of the Prophets*; either because he is ashamed to own the main Discourse, or else hath a Design to throw the *odium* upon me of *Heterodoxy in Religion*. When as indeed these came in but *accidentally*, and we had but a short *Contrast* about *them*, which I have *faithfully related*,

THE CONCLUSION.

Containing *Observations about the Censure of Atheism, applied to Philosophical Men*; and the *Authors Apology to the ROYAL SOCIETY*, and other generous Philosophers.

BY this I believe you see how *little Reason* there was in the *Disputer's Discourse*,

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scourge, and how *little Justice* in his *foul Imputation*; upon the occasion of which, if you are not quite tired already, I shall by way of *Conclusion* offer you a *Remarque* or two concerning the *Charge* of *Atheism*, of which some fierce People are very *liberal*.

About it I take notice, That *Philosophical Men* are usually dealt with by the *zealous*, as the greatest *Patrons* of the *Protestant Cause* are by the *Sects*. For as the *Bishops* and other *Learned Persons*, who have *most strongly* oppugned the *Romish Faith*, have had the ill luck to be accused of *Popery* themselves; in like manner it happens to the *humblest* and *deepest Inquisitors* into the *works* of *God*, who have the *most* and *fullest Arguments* of his *existence*, have raised *impregnable Ramparts* with much *industry* and *pious pains* against the *Atheists*, and are the *only men* that can with success serve *Religion* against the *godless Rout*; These, *Superstitious Ignorance* hath always made the loudest out-cry against, as if themselves were *guilty* of *that* which they have most happily *oppugned* and *defeated*. And the certain way to be esteemed an *Atheist* by the *fierce* and *ignorant Devoto's*, is to study to lay the *Foundations* of
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Religion sure, and to be able to speak groundedly and to purpose against the desperate Cause of the *black Conspirators* against Heaven. This I confess hath been one of the chief Employments of my *time* and *thoughts*; and on this account I reckon, I must be content with my share in the *abuse*, when *greater*, and *better*, and *deeper* men have been *pelted* with this *Dirt*, while they have been labouring in the *Trenches*, and endeavouring to secure the *Foundations* of the *Holy Fabrick*.

But besides I observe, That *narrow*, *angry* People take occasion to charge the *freer Spirits* with *Atheism*, because they move in a *larger Circle*, and have no such *fond adherence* to *some Opinions* which they *adore* and count *Sacred*. And for my own part, I confess I have not *Superstition* enough in my *Spirit* or *Nature*, to incline me to doat upon all the Principles I judge *true*, or to speak so *dogmatically* about them as I perceive *confident* and *disputing* men are wont. But contenting my self with a *firm Assent* to the *few practical Fundamentals* of *Faith*, and having *fix'd that end* of the *Compass*, I desire to preserve my *Liberty* as to the *rest*, holding the *other* in such a posture, as may be ready to draw those *Lines*, my Judgment

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ment informed by the *Holy Oracles*, the *Articles of our Church*, the *Apprehensions of wise Antiquity*, and my *particular Reason*, shall direct me to describe. And when I do that; 'tis for *my self*, and my *own satisfaction*; but am not concern'd to impose my *Sentiments* upon *others*: nor do I care to endeavour the change of their minds, though I judge them mistaken, as long as *Vertue*, the *Interests of Religion*, the *Peace of the world* and *their own* are not prejudiced by their *Errours*. By this *modest indifference* I secure *Charity* for all the *diversities of Belief*, and *equally* offer my *Friendship* and *Converses* to the several *Sects* and *Perswasions*, that stick to the *plain Principles of the Gospel* and a *Vertuous Life*, overlooking their particular *fondnesses and follies*. This is the *Temper of my Genius*, and *this* some *warm Folks*, who have more *heat* than *light*, are apt to call *Scepticism* and *cold Neutrality*: But that it deserves *better names*, I have made appear in some other *Papers*; and I have a little *Interest* to remark further,

That 'tis the *misfortune* of men of *Philosophical inclination*, where they escape the reproach of the more desperate *Atheism*, at least to meet the *imputation* of a *bordering impiety*,

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impiety, the Contempt of the Holy Scriptures. I am not to answer for all the *Pretenders to Philosophy*: but this I can say, That those of the *graver and better Genius*, have such an apprehension of the *Divine Oracles*, as will effectually secure them from suffering diminution from any *Disclosures in Nature*: And that is, *That those Holy Records speak for the most part in the Language of Sense, being suted to Plebeian Capacities, and intended for Instructions in Life and Manners; not for nicer Informations in things of deeper Speculation and Theory.* Upon which accounts they reckon, that we are not to expect from them the *Propositions of Philosophy*, nor to wonder or be stumbled though the *literal Text* do not answer *Philosophical exactness*, which is not the *thing the inspired Book intends*. So that whatever *Discoveries* are made by the *Inquirers into Nature*, the *Sacred Authority* stands firm, while they judge by *this Rule of Interpretation*. But of *this* again in a fitter place, at present my own Concerns call upon me to say somewhat for my self; since my *enrag'd Antagonist* hath from our Discourse (how justly we have seen already) reported me an *Enemy to the Scriptures*.

And now one would think it should be
very

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very *needless* and *improper*, that *one* who *Ministers* in the *eternal Gospel*, should say any *more* than what he doth *twice* every *Week* in those *Publick Instructions* drawn from the *Sacred Volume*, to justify his being no *despiser* of it: But there are a sort of People with whom one *perverse, illogical, uncharitable deduction* of their own will signify more, to fasten an *odious* thing upon him that dissents from them, than a thousand professions of *his* to the *contrary* can do to clear him from the *malicious Charge*. For *such*, 'tis an happy turn that we are to be judged by a more equal *Tribunal* than *theirs*, and they would be loth to be *tryed themselves* by *such Measures*. Were these the only Persons I have to deal with, I should spare my self *these* pains; for I know, *what I write* will not be more *plain* and *credible* than *what I say*. But *others* are to be consider'd, of more *Christian* and *candid* tempers, upon whom *envious* Traducers may fasten some odd *thoughts* and *suspensions*: To such I declare, That in my first *Education* I was continually instructed into a *Religious* and *fast adherence* to every thing I was *taught*, and a *dread of dissenting* in the *least Article*. This Discipline I underwent in my *younger days*, and thought very

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very strangely of those that believed any thing different from the *Opinions* of my *Instructors*. But advancing in years, and coming to a freer exercise of mine own mind, I began to make *Reflexions* upon the vast *diversities* and *variety* of *Apprehensions* and *Religions* in the *World*; I consider'd, That they were all as *confident* in *their way*, as I in *that* wherein I was *instructed*; and the *greatest* part had nothing but their *Education* for their *inducement*. I thought how easie we are in our *first Age*; and that though *Children* must *believe*, yet *Men*, especially those bred in the way of *Study*, must *Try*. I consider'd what I should first advise an *Heathen* or *Mahometan* to do, who had been bred up to *Idolatry* and *Fables*; and upon the consult with my self, *concluded*, That it should be to look about him, and to *examine* other *Religions*, regarding his *own* with the same eye of *indifferency* and *suspension*, as if he had never been born under *that Faith*, which was a thing *extrinsick* and *accidental*, and therefore not fit to make an *Argument* to ingage a *reasonable* belief; and when I had so thought, I turn'd the *Tables*, and took the *same Counsel* *my self*.

I therefore bent my chief *Studies* and *Endeavours*

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Endeavours to know the *Truth* of the *Christian Faith* ; and after the *Foundations* laid, in the settling the grand *Article*, The *BEING OF A GOD*, and the consequent Doctrines of *Natural Theology*, I sate me down to inquire about the *Authority* of the *Holy Scriptures* ; not that I positively *doubted* or *distrusted* their *veracity*, but that I might have a *firm* bottom, and be able to give an account of my *Faith* and *Hope*. In my Inquiry, the first Discourses I met with on the Subject did not at all *satisfie*, but seemed weak and hugely *obnoxious*: But in the progress of my search, I lighted on those grounds which (I thank God) *quieted* my *mind*, and gave me the most *Demonstrative assurance* that the nature of the thing could bear, of the truth and certainty of those *Sacred Writings*, which undoubtedly contain the *fullest Discoveries* of the *Divine wisdom* and *Perfections*, which I *infinitely* admire ; and shall *eternally* adore that Goodness that blest the Sons of men with such clear Discoveries of his Will. And though I perceive that the *Follies* and *Superstitions* of *Sects*, who have the *Holy Oracles* always in their mouths, and *press* them for the Service of their conceits ; have prejudiced some of the pre-
tenders

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tenders to Reason against them; yet this I see, That the *wiser, freer, better,* and more *reasonable* any man is, the greater still is his *Veneration* of those *Holy Records*, and the relish of them increaseth with our Improvements in *Vertue* and *Goodness*. This Testimony I must give here, and more I have to say in another place.

And now I had ended your trouble, but that upon the cast of my thoughts back I have considered, that my main business being the *Recommendation* and *Advancement* of the *Modern Useful Knowledge*, I need make an *Apology* to the generous Friends of *that way*, and particularly the *ROYAL SOCIETY*, for my Discourse of *Them*, and those their *great Designs*, in a Treatise that contains matter of *difference* and *contest*, which are so *fundamentally* contrary to their *Spirit* and *Endeavours*; and it may perhaps be feared, that some will take occasion hence to look on the *Neoterick Philosophers* as but a *new sort of Disputers*. To which I say, That for my publick appearance in a *Controversie*, I have already given such an Account, as *may*, I hope, *satisfie* the *Candid* and *Ingenious* of the *necessity* that inforced it; and for the apprehension of raising *mean* and *injurious* thoughts

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thoughts of the *Practical Philosophers*, by *defending* them in a Book of *Difference*, I hope it is causeless, since I have from first to last represented their Aims and Designs as things very *different*, yea perfectly opposite to that Spirit and Genius; and I shall now for a close assure you again, That there is nothing tends more to the undermining and supplanting the *humour* of *Disputing*, than the *Experimental* and *Free Philosophy*. For this *inlargeth* the Mind, and gives it a *prospect* of the *vastness* of things, and the *imperfections* of our *Knowledge*, the *Difficulties* that are to be incountred in the search of Truth, and our *liableness* to *deception*, the *stumbles* of *Confidence*, the *prejudices* of *Education*, the *shortness* of our *Senses*, the *precipitancy* of our *Understandings*, and the *malign influence* of our *Affections*; I say, the *Free* and *Real Philosophy* makes men deeply sensible of the infirmities of humane Intellect, and our manifold hazards of *mistaking*, and so renders them *wary* and *modest*, *dissident* of the *certainty* of their *Conceptions*, and averse to the *boldness* of *peremptory asserting*. So that the *Philosopher* thinks *much*, and *examines* many things, separates the *Certainties* from the *Plausibilities*, that which is *presumed* from

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from *that* which is prov'd, the *Images* of *Sense*, *Phansie*, and *Education*, from the *Dictates* of *genuine* and *impartial Reason*. Thus he doth before he *Assents* or *Denies*; and *then* he takes with him also a *Sense* of his own *Fallibility* and *Defects*, and never concludes but upon resolution to alter his mind upon contrary evidence. Thus he conceives *warily*, and he speaks with as much *caution* and *reserve*, in the humble *Forms* of [*So I think*, and *In my opinion*, and *Perhaps 'tis so—*] with great difference to *opposite Perswasion*, candour to *dissenters*, and *calmness* in *contradictions*, with *readiness* and *desire to learn*, and great delight in the *Discoveries* of *Truth*, and *Detections* of his *own Mistakes*. When he argues he gives his *Reasons* without *passion*, and *shines without flaming*, discourses without *wrangling*, and *differs* without *dividing*. He catcheth not at the *Infirmities* of his *Opposite*, but lays hold of his *Strength*, and weighs the substance without blowing the *dust* in his eyes. He entertains what he finds *reasonable*, and *suspends* his judgment when he doth not clearly *understand*. This is the Spirit with which men are inspired by the *Philosophy* I recommend. It makes them so *just*, as to

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allow that liberty of judgment to *others*, which *themselves* desire, and so prevents all *imperious Dictates* and *Imposings*, all *captious Quarrels* and *Notional Wars*. And that this is the *Philosophick Genius*, may be shewn in a *grand Instance*, the *ROYAL SOCIETY*, which is the *Great Body* of *Practical Philosophers*. In *this Assembly* though it be made up of all kinds of *Dispositions*, *Professions*, and *Opinions*; yet hath *Philosophy* so rarely temper'd the *Constitution*, that those that attend there, never see the least inclination to any unhandsom *opposition* or uncivil *reflexion*, no bold *obtrusions* or confident *sayings*. The forbearing such Rudenesses is indeed a *Law* of *that Society*, and their *Designs* and *Methods* of *Inquiry* naturally form men into the *modest* temper, and secure them from the danger of the *quarrelsome* Genius. This is palpable evidence of the *sweet* humour and *ingenious Tendencies* of the *Free Philosophy*; and I believe 'twill be hard to shew such another Example in any so great a Body of *differing Inclinations* and *Apprehensions*. Thus the *Experimental Learning* rectifies the *grand abuse* which the *Notional Knowledge* hath so long foster'd and promoted, to the *hinderance* of *Science*, the disturbance of

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of the World, and the prejudice of the *Christian Faith*. And there is no doubt but as it hath altered and reformed the *Genius* in matters of natural *Research* and *Inquiry*; so it will in its progress dispose mens *Spirits* to more *calmness* and *modesty*, *charity* and *prudence* in the Differences of *Religion*, and even silence *Disputes* there. For the *free sensible* Knowledge tends to the altering the *Crafs* of mens minds, and so cures the *Disease* at the *root*; and *true Philosophy* is a *Specifick* against *Disputes* and *Divisions*.

Thus I might run out into a large *Discourse* on this Subject; but I have said *enough* for my *present* purpose, and I doubt too *much* for your *patience*; and therefore I shut up with the assurance of my being,

S I R,

Your faithful Friend

and Servant,

JOS. GLANVILLE.



ERRATA.

PAge 26. line 6. for *Philophy* read *Philosophy*.
p. 30. l. 11. for *Elipsis* r. *Ellipsis*. Id. l. 19.
p. 33. l. 18. for *adseſted* r. *affected*. p. 39. l. 5. r.
Anaximenes. p. 43. l. 16. r. *one*. Id. l. 24. r.
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l. 24. r. 2 Cor. xii.





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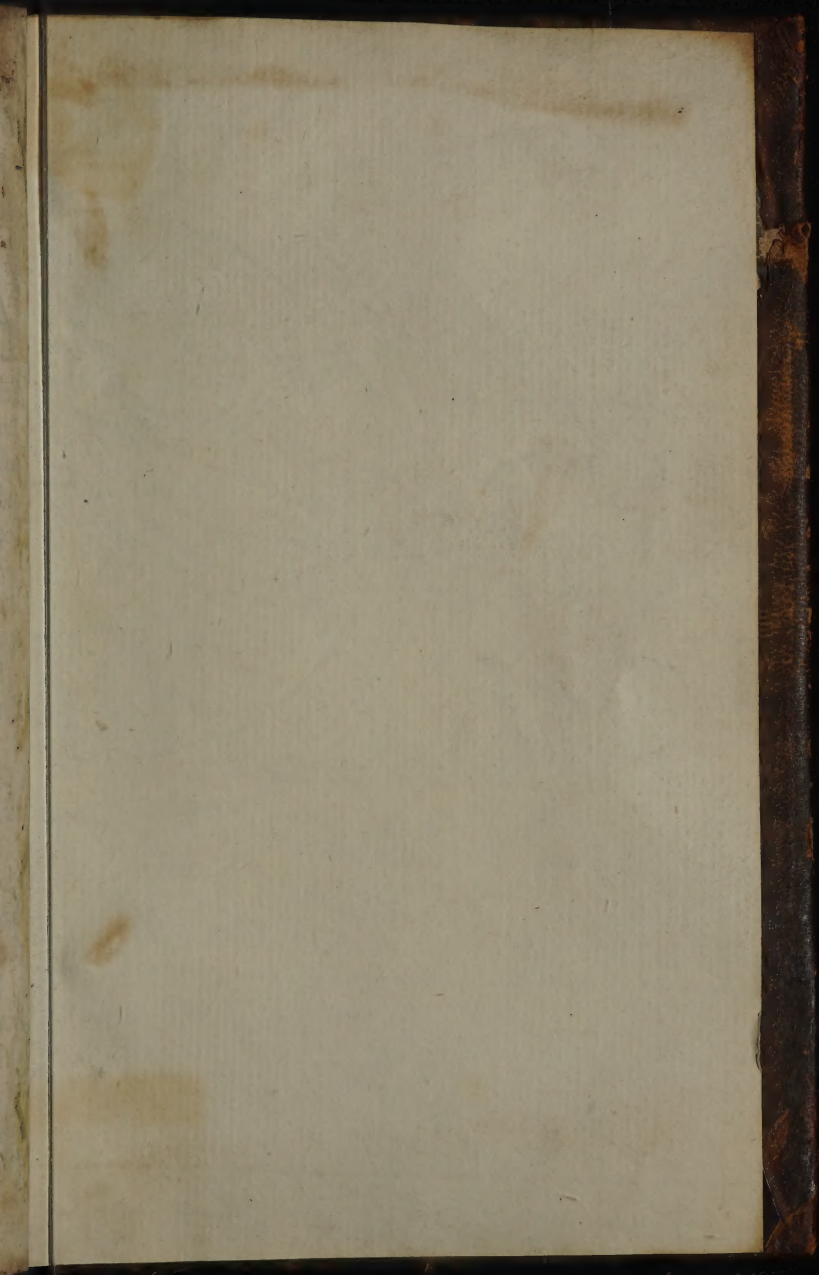
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